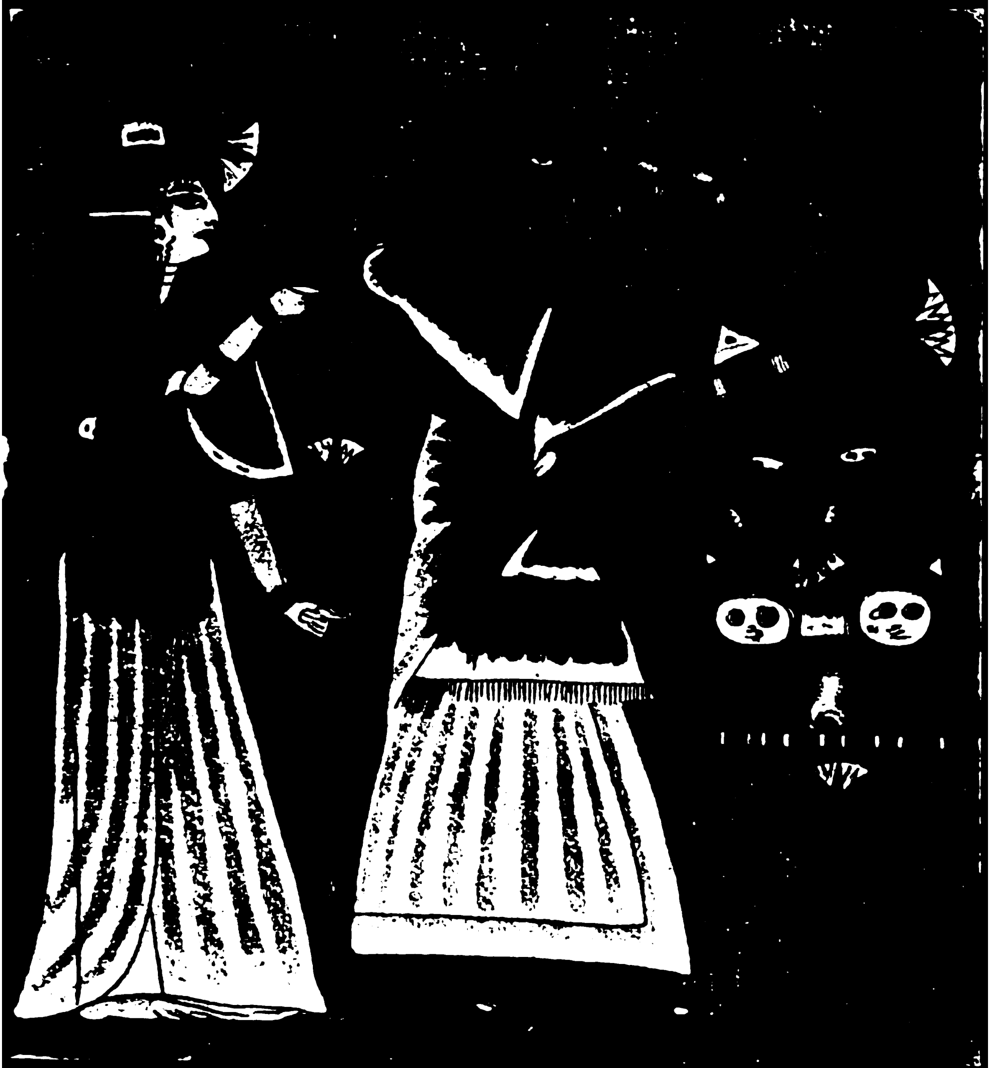


Journal and Proceedings of the Hamilton Association

Hamilton Association

JOURNAL AND PROCEEDINGS

—OF THE—

Hamilton Association

1886-7 AND 1887-8.

PART IV

CONTENTS.

AUTHORS OF PAPERS ARE ALONE RESPONSIBLE FOR THE STATEMENTS MADE AND THE OPINIONS EXPRESSED THEREIN.

PRINTED FOR THE HAMILTON ASSOCIATION BY THE SPECTATOR PRINTING COMPANY.

1888.

JOURNAL AND PROCEEDINGS

—OF THE—

Hamilton Association

1886-7 AND 1887-8.

EDITED BY THE RECORDING SECRETARY.

PART 4.

Authors of Papers are alone responsible for the statements made and the opinions expressed therein.

PRINTED FOR THE HAMILTON ASSOCIATION BY THE
SPECTATOR PRINTING COMPANY.

1888.

2 4/7

HAMILTON ASSOCIATION.

(For the Cultivation of Literature, Science and Art.)

OFFICERS FOR 1886-7.

PRESIDENT.

Rev. C. H. Mockridge, D. D.

VICE-PRESIDENTS.

Rev. Samuel Lyle, B. D. Matthew Leggat.

SECRETARIES.

H. B. Witton, Jr., B. A. A. Alexander, F. S. Sc.

TREASURER.

Richard Bull.

CURATOR.

Alexander Gaviller.

COUNCIL.

J. Alston Moffat. Samuel Slater. James Leslie, M. D.
C. S. Chittenden D. D. S. William Milne.

AUDITORS.

A T. Neill and W. A. Child, M. A.

OFFICERS FOR 1887-8.

PRESIDENT.

Rev. Samuel Lyle, B. D.

VICE-PRESIDENTS.

B. E. Charlton. W. A. Child, M. A.

SECRETARIES.

H. B. Witton, B. A. A. Alexander, F. S. Sc., Lon., Eng.

TREASURER.

Richard Bull.

CURATOR AND LIBRARIAN.

Alexander Gaviller.

COUNCIL.

J. Alston Moffat, P. L. Scriven, C. S. Chittenden,
W. Milne, Jas. Leslie, M. D.

MUSEUM AND LIBRARY.

Arcade Building, James St. North, Hamilton.

NOTICE.

The Hamilton Association was instituted on 2nd November, 1857, and continued its regular meetings to the close of the year 1860. During the period between 1861 and 1871 the meetings were held at irregular intervals, the office bearers of 1860 holding office in the meantime. During the years 1871, 2, 3, 4 and 5 the Association was more active in its work, regular meetings being held. An interregnum of four years ensued from 1875 to 1880, during which time the Council met at stated intervals. From 1880 to the present time the Association has been in active operation, during which period, in addition to the regular monthly meetings, special meetings have been held under the direction of the Council, the Annual Meeting held in May, 1888, being the one hundred and thirty-ninth meeting of the Association.

The Association was incorporated in 1883.

MEMBERS OF COUNCIL.

1857—Judge Logie; Geo. Lowe Reid, C. E.; A. Baird; C. Freeland.

1858—Judge Logie; C. Freeland; Rev. D. Inglis, D.D.; Adam Brown; C. Robb.

1859—Rev. D. Inglis, D.D.; Adam Brown; Judge Logie; C. Freeland; R. Bull.

1860—J. B. Hurlburt, M.A., L.L.D.; C. Freeland; Judge Logie; R. Bull; Wm. Boultbee; Dr. Laing.

1871—Geo. Lowe Reid, C.E.; Rev. W. P. Wright, M.A.; A. Macallum, M.A.; A. Strange, M.D.; Rev. A. B. Simpson.

1872—Judge Proudfoot; Rev. W. P. Wright, M.A.; John Seath, M.A.; H. D. Cameron; A. T. Freed.

1873—Judge Logie; T. McIlwraith; Rev. W. P. Wright, M.A.; A. Alexander; I. B. McQuesten, M.A.

1874—Judge Logie; T. McIlwraith; Rev. W. P. Wright, M.A.; A. Alexander; I. B. McQuesten, M.A.

1875—Judge Logie; T. WcIlwraith; Rev. W. P. Wright, M.A.; A. Alexander; I. B. McQuesten, M.A.

1880—M. Leggatt; I. B. McQuesten, M.A.; A. Alexander; Rev. A. Burns, M.A., L.L.D., D.D.

1881—T. McIlwraith; H. B. Witton; A. T. Freed; Rev. W. P. Wright, M.A.; A. F, Forbes.

1882—T. McIlwraith; H. B. Witton; A. T. Freed; A. F. Forbes; Rev. C. H. Mockridge, M.A., D.D.

1883—A. Alexander; A. Gaviller; A. F. Forbes; T. McIlwraith; R. Hinchcliffe.

1884—A. Gaviller; A. F. Forbes; T. McIlwraith; R. Hinchcliffe; W. A. Robinson.

1885—W. A. Robinson; S. Briggs; G. M. Barton; J. Alston Moffat; A. F. Forbes.

1886—J. Alston Moffat; Samuel Slater; Wm. Milne; James Leslie, M.D.; C. S. Chittenden.

1887—J. Alston Moffat; Jas. R. Leslie, M.D.; P. L. Scriven; Wm. Milne; C. S. Chittenden.

OFFICE-BEARERS.

	PRESIDENT.	1st VICE-PRES.	2nd VICE-PRES.	COR. SEC.	REC. SEC.	TREAS.	LIBR AND CUR.
1857	Rev. W. Ormiston, D. D.	John Rae, M.D....	J. B. Hurlburt, M. A , L.L.D.	T. C. Keefer, C. E.	Dr. Craigie....	W. H. Park...	A. Harvey.
1858	John Rae, M. D ...	Rev. W. Ormiston, D. D.	J. B. Hurlburt, M. A., L.L.D.	T. C. Keefer, C. E.	Dr. Craigie....	W. H. Park...	A. Harvey.
1859	Rev. W. Ormiston, D. D.	J. B. Hurlburt, M. A., L.L.D.	Chas. Robb........	T. C. Keefer, C. E.	Dr. Craigie....	W. H. Park...	A. Harvey.
1860	Rev. W. Inglis, D.D.	T. McIlwraith.....	Rev. W. Ormiston, D. D.	Dr. Craigie....	Wm. Craigie...	W. H. Park...	Chas. Robb
1861	Rev. W. Ormiston, D. D.	J. B. Hurlburt, M. A., L.L.D.	Rev. W. Inglis, D. D.	Dr. Craigie....	Wm. Craigie...	W H. Park...	T. McIlwraith.
1871	W. Proudfoot......	Judge Logie.......	R. Bull............	J. M. Buchan, M A.	I.B. McQuesten M. A.	W. G. Crawford	T. McIlwraith.
1872	Judge Logie.......	H. B. Witton, M.D.	R. Bull............	J. M. Buchan, M. A.	I.B. McQuesten M. A	W. G Crawford	T. McIlwraith.
1873	H B. Witton, M. P.	J. M. Buchan, M.A.	A. T. Freed.......	Geo. Dickson, M. A.	Geo. Dickson, M. A.	R. Bull........	T. McIlwraith.
1874	H. B. Witton, M. P.	J. M. Buchan, M.A.	A. T. Freed.......	Geo. Dickson, M. A.	Geo. Dickson. M. A.	R. Bull........	T. McIlwraith.
1875	H. B. Witton......	J. M. Buchan, M A.	W. H. Mills.......	Geo. Dickson. M. A.	Geo. Dickson, M. A.	A Macallum, M A.	T. McIlwraith.
1880	T. McIlwraith.....	Rev. W. P. Wright, M. A.	H. B. Witton......	R. B. Hare, Ph. D.	Geo. Dickson, M. A.	R. Bull........	A. T. Freed.
1881	J. D. McDonald, M. D.	R. B. Hare, Ph. D.	B. E. Charlton.....	Geo. Dickson, M. A.	A. Robinson M. A.	R. Bull........	W. H. Ballard, M. A.
1882	J. D. McDonald, M. D.	B. E. Charlton.....	J. A. Mullin, M. D.	Geo. Dickson, M. A.	Wm. Kennedy.	R. Bull......	W. H. Ballard, M. A.

1883	J. D. McDonald, M. D.	B. E. Charlton.....	H. B Witton......	Geo. Dickson, M. A.	Wm. Kennedy.	R. Bull........	W. H. Ballard, M. A.
1884	J. D. McDonald, M. D.	H. B. Witton......	Rev. C. H. Mockridge, D. D.	Geo. Dickson, M. A.	A. Alexander..	R. Bull........	Wm Turnbull.
1885	Rev. C. H. Mockridge, M A., D.D	Rev. S Lyle......	W. Kennedy	Geo. Dickson, M. A.	A. Alexander..	R. Bull	A. Gaviller.
1886	Rev. C. H. Mockridge, M A., D D.	Rev. S. Lyle......	Matthew Leggat...	Geo. Dickson, M. A	A. Alexander, F. S. Sc	R Bull........	A. Gaviller.
1887	Rev. S. Lyle, B.D .	B. E Charlton.....	W. A Child, M. A.	H. B. Witton, B. A.	A. Alexander, F. S. Sc	R Bull........	A. Gaviller.
1888	Rev. S. Lyle, B.D..	B. E Charlton.....	W. Kennedy	H. B. Witton, B A.	A. Alexander, F. S. Sc.	R Bull........	A. Gaviller.

OFFICE-BEARERS.

	PRESIDENT.	1st VICE-PRES.	2nd VICE-PRES.	COR. SEC.	REC. SEC.	TREAS.	LIBR AND CUR.
1857	Rev. W. Ormiston, D. D.	John Rae, M.D....	J. B. Hurlburt, M. A, L.L.D.	T. C. Keefer, C. E.	Dr. Craigie....	W. H. Park...	A. Harvey.
1858	John Rae, M. D ...	Rev. W. Ormiston, D. D.	J. B. Hurlburt, M. A., L.L.D.	T. C. Keefer, C. E.	Dr. Craigie....	W. H. Park...	A. Harvey.
1859	Rev. W. Ormiston, D. D.	J. B. Hurlburt, M. A., L.L.D.	Chas. Robb........	T. C. Keefer, C. E.	Dr. Craigie....	W. H. Park...	A. Harvey.
1860	Rev. W. Inglis, D.D.	T. McIlwraith.....	Rev. W. Ormiston, D. D.	Dr. Craigie....	Wm. Craigie...	W. H. Park...	Chas. Robb
1861	Rev. W. Ormiston, D. D.	J. B. Hurlburt, M. A., L.L.D.	Rev. W. Inglis, D. D.	Dr. Craigie....	Wm. Craigie...	W H. Park...	T. McIlwraith.
1871	W. Proudfoot......	Judge Logie.......	R. Bull...........	J. M. Buchan, M A.	I.B. McQuesten M. A.	W. G. Crawford	T. McIlwraith.
1872	Judge Logie.......	H. B. Witton, M.D.	R. Bull...........	J. M. Buchan, M. A.	I.B. McQuesten M. A	W. G Crawford	T. McIlwraith.
1873	H B. Witton, M. P.	J. M. Buchan, M.A.	A. T. Freed.......	Geo. Dickson, M. A.	Geo. Dickson, M. A.	R. Bull........	T. McIlwraith.
1874	H. B. Witton, M. P.	J. M. Buchan, M A.	A. T. Freed.......	Geo. Dickson, M. A.	Geo. Dickson. M. A.	R. Bull........	T. McIlwraith.
1875	H. B. Witton......	J. M. Buchan, M A.	W. H. Mills.......	Geo. Dickson. M. A.	Geo. Dickson, M. A.	A Macallum, M A.	T. McIlwraith.
1880	T. McIlwraith.....	Rev. W. P. Wright, M. A.	H. B. Witton......	R. B. Hare, Ph. D.	Geo. Dickson, M. A.	R. Bull........	A. T. Freed.
1881	J. D. McDonald, M. D.	R. B. Hare, Ph. D.	B E. Charlton.....	Geo. Dickson, M. A.	A. Robinson M A.	R. Bull........	W. H. Ballard, M. A.
1882	J. D. McDonald, M. D.	B. E. Charlton.....	J. A. Mullin, M. D.	Geo. Dickson, M. A.	Wm. Kennedy.	R. Bull.......	W. H. Ballard, M. A.

1883	J. D. McDonald, M. D.	B. E. Charlton.....	H. B Witton......	Geo. Dickson, M. A.	Wm. Kennedy.	R. Bull........	W. H. Ballard, M. A.
1884	J. D. McDonald, M. D.	H. B. Witton......	Rev. C. H. Mockridge, D. D.	Geo Dickson, M. A.	A. Alexander..	R. Bull........	Wm Turnbull.
1885	Rev. C. H. Mockridge, M A., D.D	Rev. S Lyle......	W. Kennedy	Geo. Dickson, M. A.	A. Alexander..	R. Bull	A. Gaviller.
1886	Rev. C. H. Mockridge, M A., D D.	Rev. S. Lyle......	Matthew Leggat...	Geo. Dickson, M. A	A. Alexander, F. S. Sc	R Bull........	A. Gaviller.
1887	Rev. S. Lyle, B.D..	B. E Charlton.....	W. A Child, M. A.	H. B. Witton, B. A.	A. Alexander, F. S. Sc	R Bull........	A. Gaviller.
1888	Rev. S. Lyle, B.D..	B. E Charlton.....	W. Kennedy	H. B. Witton, B A.	A. Alexander, F. S. Sc.	R Bull........	A. Gaviller.

LIST OF MEMBERS.

—OF THE—

HAMILTON ASSOCIATION.

ELECTED.

1872 Alexander, A , F. S. Sc. President of the Horticultural Society.

1880 Anderson, J. N., M. D., Burlington.

1882 Anderson, James, M. D., late Resident Physician, Hamilton Hospital.

1882 Armour, Robert, C. E.

1882 Allan, Richard.

1886 Ambrose, R. W.

1885 Baker, Hugh C.

1880 Balfour, James, Architect, Hannah St. W.

1880 Ballard, W. H., M. A., Inspector of Schools, 231 King St. West.

1888 Baker, Chas. O.

1880 Barr, John A., Druggist, cor. York and McNab Sts.

1885 Barrett, T. P., Toronto.

1881 Barton, G. M., Barrister, Dundas.

1881 Boustead, W., Machinist.

1881 Bowman, Wm., Wholesale Hardware Merchant, 56 Hunter St. West.

1857 Brown, Adam, Wholesale Grocer, 13 Herkimer St. West.

1884 Brown, W. E., Cashier, Brown, Balfour & Co., 36 Jackson St. West.

1885 William Bruce.

1880 Black, George, Manager G. N. W. Telegraph Co.

1885 Buchanan, W. W., editor.
1857 Bull, Richard, Treasurer Hamilton Association, 14 Hunter St. East.
1880 Burns, Rev. A., M. A.. L. L. D., D. D., President Hamilton Wesleyan Female College.
1887 Burgess, T. J. W., M. D., F. R. S. C.
1880 Briggs, S.. Superintendent Hart Emery Wheel Co.
1880 Campbell, P. S., M. A., Principal Collegiate Institute.
1887 Chisholm, James, B. A.
1886 Cockburn, T. W. L, M. D.
1887 Colquohoun, E. A. banker.
1880 Cummings, Jas. Collector of Taxes, Ex-Chairman Board of Education, City Hall.
1880 Chittenden, C. S., D. D. S., 69 Bay St. South.
1880 Charlton, B. E., President Hamilton Vinegar Works Co., 58 John North.
1885 Chapman, Chas., Herkimer St.
1884 Childs, W. A, M. A.
1880 Clark, J. A., Druggist, Jackson St. West.
1884 Carmichael, Rev. Hartley, B. A.
1872 Dickson, Geo., M. A., Principal, Upper Canada College
1880 Dillabough, E. H., M. D., 18 Gore St.
1882 Dalley, F. F., Druggist, 99 James Street North.
1881 Evans, J. DeVille.
1882 Edwards, W. A., Architect.
1887 Farmer, T. D. J., B. C. L.
1888 Fairchild R. M., M. D
1870 Freed, A. T., Editor Spectator.
1886 Forneret, Rev. George, M. A.
1880 Forbes, A F., Stock Broker.
1880 Fletcher, Rev. D. H., 58 McNab St. South.
1880 Foster, W. C., Artist.
1881 Fearman, F. W., Chairman Board of Education, 58 Stinson St.
1880 Findlay, W. F., Accountant.
1882 Ferres, James, Hardware.
1886 Fraser, Donald.
1885 Garland, Louis, Druggist, King St. East.
1880 Gaviller, Alex., 21 Herkimer St.
1882 Gaviller, E. A., M. D.

1887 Green, Joseph.
1883 Crossman, Julius, Music, 22 West Avenue South.
1883 Gibson, J. M., M. A., LL. B., M. P. P., Lt. Col., Barrister, 102 Main St. West.
1886 Geiger, E. A.
1888 Galbraith, W. S.
1887 Grant, Alexander A.
1886 Goering, William.
1888 Hanham, A. Thos.
1887 Hobson A. Thos.
1880 Husband, G. E., M. D., 75 Main St. West.
1882 Hoodless, John, Furniture Manufacturer, 51 King St. West.
1882 Hemming, G. E. Barton, City P. O.
1882 Harris, W. J., 14 Market Sq.
1883 Hillyer, E. S., M. D., 9 Main St. East.
1882 Kennedy, Wm.
1886 Kitson, E. E., Barrister.
1882 King, F. W.
1886 Land, Allan.
1880 Lemon, Charles, Barrister, Charles St.
1880 Leitch, John, Central Iron Works.
1880 Lyle, Rev. S., B. D., 20 Jackson St. West.
1880 Littler, John.
1880 Littlehales, Thos., Manager and Engineer, Hamilton Gas Light Co.
1880 Leslie, Jas., M. D., 37 Main St. West.
1857 Leggatt, M., Wholesale Hardware, 5 Duke St.
1884 Lee, Lyman, Law Student.
1882 Laidlaw, Rev. R. J., 85 Hughson St. South.
1884 Lafferty, James, M. D.
1887 Logie, W. A., B. A.
1886 Martin, Edward, Q. C.
1887 Moore, Alex. H., Banker.
1880 Muir, John, M. A., Barrister, Deputy Judge, 37 Duke St.
1880 Moffat, J. Alston, Member of the Council of the Entomological Society of Canada.
1880 Moodie, John, 16 King St. West.
1881 Mockridge, Rev. C. H., M. A. D. D., Rector Christ Church.
1887 Mills, Geo. H., Barrister.

1887 Morris, Thos.
1886 Morgan, W. S.
1857 Malloch, A. E., M. D., 70 James St. South, Examiner in Surgery, Toronto University.
1882 Munro, A., Com. Traveler, City.
1870 Mullen, J. A, M. D., Ex-President of the Dominion Medical and Surgical Society, 124 James St. North.
1886 Milne, Alexander, Builder.
1885 Mills, F. H.
1886 Miller, Rev. A. E.
1870 Milne, Wm., Wine Merchant, Wentworth St. North.
1883 Murton, J. W., Coal Merchant, East Hamilton.
1884 Mason, J. J., 63 Hunter St. West.
1884 Murton, E. C., East Hamilton.
1837 McIlwraith, Thomas, Superintendent for Ontario of the Ornithological Society of N. America, Cairn Brae, City.
1886 McKeand, George.
1886 MacKelcan, H. A., Barrister.
1884 McLaren, Henry, James St. South.
1880 McPhie, Donald, Sanitary Engineer, 57 East Ave. South.
1880 Macdonald, John, D. M. D., Ex-President Ontario Medical Association, 10 Duke St.
1884 McRae, Colin.
1887 Nelligan, J. B., Assessor.
1880 Neill, A. T., Secretary, Geological Section, HAMILTON Association, Canada Life Chambers.
1885 Papps, G. S., Barrister.
1885 Plant, John, Wood Merchant.
1882 Powis, Alfred, Commission Merchant, Concession St.
1883 Pearson, John, Accountant.
1886 Rattray, Marie L.
1880 Robertson, C., M. A., Classical Master, Collegiate Institute.
1886 Ross, George, B. A.
1881 Ross, A. M., Painter, 68 Colborne St.
1881 Reynolds, T. W., M. D.
1880 Ryall, I., M. D., Physician Board of Health, 71 Main St East.
1872 Roseburgh, J. W., M. D., 52 James St. South.
1887 Roberts, Albert, U. S. Consul.

1882 Robinson, W. A., 6 Hannah St. East, Hamilton.
1883 Robertson, H. H., Barrister, Rannoch Lodge.
1885 Scott, C. S.
1880 Sutherland, Angus, Grocer.
1880 Scriven, P. L., Engraver, 111 Jackson St. West.
1885 Smart, W. Lynn.
1882 Smith, Wm., 74 Catharine St. North.
1887 Sanford, Hon. W. E.
1883 Slater, S., Treasurer Landed Banking and Loan Co.
1880 Thomson, John, Chief Appraiser, H. M. Customs, Cannon St. East.
1880 Turnbull, W., City Assessor, Librarian, Hamilton Association, 10 Wilson St.
1881 Tuckett, Geo. E., King St. West.
1881 Tuckett, Geo. T.
Vernon, Elias, M. D., James St. South.
1886 Ward, Rev. Robt., M. D., LL. D.
1857 Witton, H. B., H. M. Inspector of Canals, 12 Murray St. West.
1885 Witton, H. B. jr., M. A.
1887 Whipple, Vernon B.
1881 Williams, J. M., jr.
1888 Williams, C. J.
1884 Young, Wm., 45 Jackson St. West.

CORRESPONDING MEMBERS.

1881 Clark, Chas. K., M. D., Rockford Asylum, Kingston.
1881 Van Wagner, P. S., J. P., Stoney Creek.
1884 Bull, Rev. George A., M. A., Barton.
1882 Lawson, A., M. A., Geological Survey of Canada.
1881 Spencer, J. W., Ba. Sc., Ph. D., F. G. S., Columbia, Mo., U. S.
1870 Wright, Prof. W. P., M. A. California.
1871 Seath, John, M. A., High School Inspector, St. Catharines.
1885 Frood, T., Kincardine, Ont.

HONORARY MEMBERS.

1881 Grant, Lt-Col, John St. South.
1882 Macoun, John, M. A., Government Botanist and Naturalist, Geological Survey of Dominion of Canada.

1885 Dawson, Sir J. William, F. R. S., F. G. S., F. R. S. C., Principal McGill College, Montreal.
1885 Sanford, Fleming, C. E., C. M G., Ottawa.
1885 Wilson, Sir D, LL. D., Principal, University of Toronto.
1885 Farmer, William, Engineer, New York.
1885 Ormiston, Rev. Wm., D. D., New York.
1885 Rae, John.
1885 Hurlburt, J. B., M. A., L.L. D., Ottawa.
1886 Small, H. B., Ottawa.
1886 Charlton, Mrs. B. E.
1887 Keefer, Thomas C., C. E., Ottawa.

LIFE MEMBER.

1885 Proudfoot, Vice-Chancellor, Toronto.

ABSTRACT OF MINUTES

OF THE

HAMILTON ASSOCIATION

SESSION 1886-87.

FIRST MEETING—Thursday, 11th November, 1886.

Rev. Dr. Mockridge in the chair.

The minutes of the previous meeting were read and approved.

The Secretary reported that the tender of A. Lawson & Co. for the printing of the proceedings of 1885 6, being the lowest, had been accepted, and that one hundred pages of the work were in type.

It was also announced that the government grant of $400 had been received.

The Corresponding Secretary reported that so many papers had been promised for the coming session that fortnightly meetings would be warranted.

The matter was left with the Council.

The Librarian and Curator reported the receipt of a large number of books and pamphlets from various learned societies in the old world and from the States.

The President strongly urged the desirability of increasing the library by the addition of valuable books as far as the funds of the Association would allow, and recommended the purchase of the "Narrative History of America."

The matter was left in the hands of the Council.

Dr. Mockridge then read his Inaugural Address, taking as his motto, "Man and Brute."

After the delivery of the address, Dr. Mockridge expressed a wish that, though contrary to usage, the contents of his paper

should be discussed, when Messrs. H. B. Witton, A. F. Forbes, W. Kennedy, Dr. Cockburn, G. M. Barton, Dr. Mullen and Rev. S. Lyle spoke on the subject.

It was announced that Dr. Macdonald would read the next paper on Thursday, the 25th November, the subject being "Our Cold Climate, and the Duties and Necessities it lays upon us as regards Healthy Bodies."

The meeting then adjourned.

SECOND MEETING—Thursday, 25th November, 1886.

Rev. Dr. Mockridge in the chair.

The minutes of the previous meeting were read and confirmed

The following gentlemen were duly elected, viz.: Rev. George Forneret, M. A.; George Ross, B. A.; Alexander Milne, builder; T. W. Cockburn, M. D.

Mr. William Glyndon then read a very interesting paper on "The Alexandrian Museum—Its Rise, Decline, and Fall."

A very spirited discussion followed, in which Messrs. Forbes, Child, Witton, Littlehales, Charlton, Gaviller, and the Rev. George Forneret took part.

Some of the speakers thought that the burning of this immense library was not an unmixed evil, as it stimulated research, while others thought that science, but especially History, had suffered a great loss.

The meeting then adjourned.

THIRD MEETING—9th December, 1886.

The President, Dr. Mockridge, in the chair.

The minutes of the previous meeting were read and approved.

Messrs. W. F. McGiverin, Donald Fraser and John E. Tuckett were elected members of the Association.

The Corresponding Secretary announced the receipt of *The Canadian Entomologist*, Transactions of the Manchester Zoological Society, 1886-7, Bulletin of Harvard Museum of Zoology; Transactions of the Royal Society; Annual Report of the Department of Mines of New South Wales.

The paper written by Dr. Macdonald, who was unable to be present, was read by Mr. Witton, the Corresponding Secretary. The paper was entitled "Our cold climate, and the duties and necessities it lays upon us in relation to the public health."

The paper gave rise to an instructive discussion, taken part in by Messrs. Chittenden, Forbes, Alexander, Witton, Dr. Cockburn, Revs. S. Lyle and G. Forneret, and others.

The meeting then adjourned.

FOURTH MEETING—January 13th, 1887.

Rev. Samuel Lyle, B. D., First Vice-President, presided.

The minutes of the previous meeting were read and approved.

The Corresponding Secretary reported the receipt of several reports from various learned societies.

The Curator reported having received a large number of specimens of native woods, handsomely dressed and polished to show the grain, from Messrs. Hoodless & Son, L. D. Sawyer & Co., and Messrs. Flatt & Bradley.

A glass case to contain the specimen of the Ornithorhynchus was also presented by Mr. Gaviller, the Curator.

A very cordial vote of thanks was passed to these donors for their valuable gifts to the Museum.

Mr. Child then read a paper on "Political Centralization in France." The essayist very clearly showed how the idea of political unity had arisen centuries ago, and been fostered ever since.

It was announced that the next paper would be "The Chinese, our latest neighbors."

The meeting then adjourned.

FIFTH MEETING—Thursday, 27th January, 1887.

Dr. Mockridge presided.

Minutes were read and approved.

The Council recommended the discontinuance of all the reviews and magazines which have been laid on the table for the last two years, with the exception of the Popular Science Monthly and the Scientific American Supplement.

The Association confirmed this recommendation.

Mr. Barton then read a paper, entitled "The Chinese, our latest neighbors."

Remarks were made on the paper by Messrs. Cockburn, Briggs, Witton, and others.

The meeting then adjourned.

SIXTH MEETING—Thursday, 10th February, 1887.

The President in the chair.

The minutes of the previous meeting were read and confirmed.

The following were unanimously elected members of the Association: John S. Ireland, Principal of the Art School, Thomas Hobson, and Miss Hendrie.

It was announced that the Journal and Proceedings of the Association for 1885-6, including "The Birds of Ontario," by Mr. McIlwraith, was now ready for distribution.

Rev. George Forneret read an excellent paper on "The Half-Breeds of the Northwest."

The meeting then adjourned.

SEVENTH MEETING—Thursday, 3rd March, 1887.

The President in the chair.

The minutes of the previous meeting were approved.

There being no other business, Dr. Hillyer read a paper on "The Revolution of 1688." The paper dealt exhaustively with the causes and consequences of the Revolution.

The meeting then adjourned.

EIGHTH MEETING—Thursday, 11th March, 1887.

The President in the chair.

Minutes read and approved.

Mr. Thomas Morris, merchant, was elected a member of the Association.

Mr. Witton called attention to a paper recently read in New York on Transcontinental Railways, in which the writer, an American, asserted that the Canadian Pacific stood at the head of the railways stretching from the Atlantic to the Pacific, whether its road-bed or the country through which it passed was considered. The great wealth contained in the Rocky mountains was pointed out.

The researches of Dr. Dollinger in microscopy, especially in relation to the monads, was also spoken of by Mr. Witton.

In the absence of Dr. Dee, the Corresponding Secretary read a paper on "The Early History of the Iroquois."

The paper was a valuable one, Dr. Dee being an able authority on this branch of the Indian family.

Dr Dee was elected an honorary member of the Association.

On motion, a Committee, consisting of Messrs. William Kennedy (convener), B. E. Charlton, F. W. Fearman, William Milne and William Glyndon, was appointed to collect all available information relating to Indian history, as also all relics and curiosities which in any way would throw light on the manners and customs of the aboriginal tribes of this continent, especially of the country around our city.

The meeting then adjourned.

NINTH MEETING—Thursday, 24th March, 1887.

Dr. Mockridge in the chair.

The minutes of the previous meeting were read and confirmed.

T. C. Keefer, civil engineer, of Ottawa, was elected an honorary member of the Association.

Mr. Moffat, read a valuable and interesting paper on "The Development of Insects." A lively conversation followed, in which Messrs. Scriven, Witton, Forneret, and others took part.

The meeting then adjourned.

TENTH MEETING, Thursday, 7th April, 1887.

The Rev. Samuel Lyle, D. D., in the chair.

The minutes of the previous meeting were read and confirmed.

A valuable donation of 60 maps or coast charts, of the northern and northwestern lakes, published by the war department of the United States was received from Adam Brown, Esq., M. P., for which a hearty vote of thanks was passed.

A letter was read from Vice-Chancellor Proudfoot containing a cheque for $20 for the funds of the Association, and asking to be made a life member.

By resolution his request was granted, and he was made a life member of the Association.

A cordial vote of thanks for his handsome donation was also passed.

Geo. H. Mills, barrister, and E. A. Colquhoun, bank manager, were elected members of the Association.

Mr. Wm. Milne then read his paper on "The Public's Treatment of Crime and Criminals." Mr. Milne strongly urged the need for such a treatment of the criminal classes as would create and foster a hope for a better future.

A discussion followed, taken part in by many members.

The meeting then adjourned.

ELEVENTH MEETING—Thursday, 28th April, 1887.

Dr. Mockridge presiding.

The minutes of the previous meeting were read and confirmed.

Several of the members present made strong representations of the need the Association had for a library of technical scientific books.

H. B. Witton, Jr., B. A., read a clever paper on "An Introduction to the Greek Drama."

Mr. Witton promised to continue the subject in a subsequent paper.

Albert Roberts, United States Consul for Hamilton, was elected a member of the Association.

The meeting then adjourned.

TWELFTH MEETING—12th May, 1887.

Rev. Samuel Lyle, B. D., presiding.

The minutes of the previous meeting were read and approved.

T. D. J. Farmer, B. C. L., Hon. W. E. Sanford and Joseph Green were elected members of the Association.

The question of holding a field day during the summer was discussed, and the general feeling being in favor of such a meeting, the time and place were left with the Council to fix and announce.

The meeting was then resolved into the annual meeting.

The minutes of the previous annual meeting being read and confirmed, the Secretary gave a brief verbal report of the year's work.

The Treasurer, Mr. Bull, read the financial statements, showing a balance in hand of $70.33.

The election of officers for the Session 1887-8 resulted as follows:

President, - - -	Rev. Samuel Lyle, B. D.
1st Vice-President, - -	B. E. Charlton.
2nd " - - - -	W. A. Child, M. A.
Corresponding Secretary, -	H. B. Witton, B. A.
Recording Secretary, -	A. Alexander, F. S. Sc.
Treasurer, - - - - -	Richard Bull.
Curator and Librarian, -	Alexander Gaviller.

COUNCIL—J. Alston Moffat, William Milne, James Leslie, M. D., P. L. Scriven and C. S. Chittenden.

The meeting then adjourned to meet the second Thursday of November.

SESSION 1887-88.

FIRST MEETING—Thursday, 10th November, 1887.

The President, Rev. S. Lyle, B. D., presiding.

The minutes of the previous meeting were read and approved.

The Secretary gave a brief report of the business transacted during the recess, especially referring to the successful meeting held on the third Saturday of September in the Dundas ravine.

Reference was also made to the fact that Adam Brown, Esq., M. P., had acted as our delegate at the annual meeting of the Royal Society of Canada, held at Ottawa on the 25th May last.

The Corresponding Secretary reported the receipt of a large number of publications, consisting of reports and proceedings of learned and scientific societies from all parts of the world, while Mr.

Gaviller the Curator, announced various contributions to the museum, among the principal of which was the handsome collection of curiosities and natural objects given by Mrs. Charlton.

There was also a fine specimen of the head of a Rocky Mountain sheep, presented by F. E. Kilvert, Esq , Collector of Customs. Two volumes of maps and charts, published more than one hundred years ago, given by Mr. J. H. Killey, the sword of the sword fish from Mr. Thos. Burrows, buffalo horns from Mr. L. H. Hendry, and a very fine specimen of native copper from Mr. H. Symonds. A number of smaller contributions were also reported.

On motion the best thanks of the Association were voted unanimously to these donors.

The President, Rev. Samuel Lyle, B. D., then delivered his Inaugural Address, choosing for his subject " Evolution." The history of this hypothesis was traced during the past two centuries, and while it was admitted that the study of Evolution had aided the progress of true science, and had brought out very clearly the essential oneness of the animal and vegetable kingdoms it was pointed out that there was an unbridged chasm between man and the highest form of ape. And the moral sense in man was referred to as a distinguishing mark placing man far above the lower creation.

Mr. Moffat introduced the question of the re-organization of the sections, with the hope that some active work would be done by them, and moved that the following be the sections and the chairmen of the same :

SECTION A.—Mathematics, Mechanics, Physics, Meteorology and Astronomy. Chairman—Mr. A. Gaviller.

SECTION B.—Chemistry and Mineralogy. Chairman—Dr. Chittenden

SECTION C.—Geology and Palæontology. Chairman—Mr. A. T. Neill.

SECTION D.—Biology, comprehending Botany, Zoology and Entomology. Chairman—Mr. Thos. McIlwraith.

SECTION E.—Medical and Sanitary Science. Chairman—Dr. Leslie.

SECTION F.—Geography and Ethnology. Chairman—Mr. A. F. Forbes.

SECTION G.—Literature and the Fine Arts. Chairman—Mr. B. E. Charlton.

This arrangement was carried. The meeting then adjourned.

SECOND MEETING—8th December, 1887.

The President in the chair.

The minutes of the previous meeting were read and approved.

Dr. Reynolds, the Secretary of the biological section, reported the organization of the section with Mr. McIlwraith as Chairman and himself as Secretary, and also that the first regular meeting had been held, at which Mr. Moffat had read a paper.

T. W. J. Burgess, M. D., and J. B. Nelligan were elected members of the Association.

Mr. Witton then read a paper on "The Mahabharata," the great epic poem of the Hindoos. The paper, which was a very able one, sketched the plan of the poem, and showed that it sung at great length the story of great deeds of popular interest and national importance. It was pointed out that this great poem, extending to no less than 220,000 lines, with a supplement of 16,374 couplets, reflecting in its numerous characters every phase of Hindoo life; and further, that its religious and philosophical parts made it valuable as setting forth the faith and morals still held by the vast population of British India.

Several members expressed their high estimate of the paper, and the meeting adjourned.

THIRD MEETING—26th January, 1888.

The Rev. Samuel Lyle in the chair.

The minutes of the previous meeting were read and confirmed.

Messrs. W. A. Logie, B. A., Alexander H. Moore, banker, Vernon B. Whipple and Alexander R. Grant were duly elected members of the Association.

Dr. Reynolds reported the meetings of the biological section.

Mr. Forbes reported that the geographical section had had a meeting.

Dr. Mockridge then read "Some Notes on the Waverly Novels." The notes were arranged in the order of the historical period covered by the story. The notes this evening began with "Count Robert, of Paris," and ended with "Old Mortality." Dr. Mockridge promised to read the notes on the remaining volumes on a future occasion.

After remarks by various members the meeting adjourned.

FOURTH MEETING—9th February, 1888.

Rev. Samuel Lyle, presiding.

Minutes read and confirmed.

R. M. Fairchild, M. D., and A H. Hanham were elected members of the Association.

On motion the Secretary was instructed to send a letter to the widow of the late Professor Asa Gray, the eminent botanist, and that Dr. Burgess be associated with him in preparing a resolution expressive of our high sense of the eminent services her late husband rendered to science in general, and to botany in particular.

The following is the resolution prepared:

"*Whereas*, This Association has heard with deep regret of the death of Dr. Asa Gray, of Cambridge, Mass.:

Resolved, That as a mark of our respect to his memory there be transmitted to his family a record of our profound grief at such a calamity to the botanical world; that in his life he furnished a shining example of devotion to science and thoroughness of investigation, which will always command our admiration and respect, and that though of another nationality, we cherish and revere his memory, inseparably interwoven, not only with American botany, but with the development of botanical science itself."

In the absence of Mr. William Kennedy, his paper "Some Notes on Primitive Man," was read by the Corresponding Secretary. A very high antiquity was claimed for man.

The meeting then adjourned.

FIFTH MEETING—8th March, 1888.

Mr. W. A. Robinson in the absence of the President occupied the chair.

The minutes of the previous meeting were read and approved.

A letter from Mrs. Gray, widow of Dr. Gray, acknowledging receipt of resolution passed at the last meeting and expressing her thanks for the same.

Dr. Burgess also read from the Transactions of the "Torrey Club," of New York, a reference to the same resolution.

The thanks of the Association were voted to Mrs. Nelson Mills for a specimen of "Singing Sand."

Mr. Gaviller then gave an interesting and instructive series of illustrations of atmospheric pressure with his valuable apparatus.

The meeting then adjourned.

SIXTH MEETING—Thursday, 19th April, 1988

The President in the chair.

The minutes of the previous meeting were read and approved.

On motion, a hearty vote of thanks was passed to Mr. Symmonds for his handsome and valuable contribution to the Museum of a number of beautiful models of British ships of war, made to scale.

Dr. Reynolds reported the work done in the Biological Section.

A large number of publications were reported as having been received from Messrs. Brown and McKay, the city members, and others.

The matter of appointing a delegate to the forthcoming meeting of the Royal Society of Canada, was left with the Council.

Mr. Witton, Senior, read a very interesting paper on the "Paston Letters."

Dr. Burgess and Messrs. Barton, Chittenden, and the President, with others, joined in the after discussion.

SEVENTH MEETING—10th May, 1888.

The President in the chair.

The minutes of the previous meeting confirmed.

The Corresponding Secretary reported as having received a valuable contribution to the museum, consisting of an original letter by Benjamin Franklin, written by him from London in 1771. It is the gift of Mr. A. McLean, through Mr. William Bruce, to the Association.

Dr. Burgess then read an able and very practical paper on "How Best to Study Botany." It was very clearly shown how the student could best begin and continue to pursue the study of this beautiful science until he or she had a considerable collection of the native flora of their district. The method of finding the name, and

the drying and preserving and mounting of the specimens were so set forth that all felt that they could at once begin.

Messrs. Alexander, Witton, Forbes, Ireland and others spoke to the subject.

The meeting then adjourned.

EIGHTH MEETING—Thursday, 17th May, 1888.

ANNUAL MEETING.

The President, Rev. Samuel Lyle, B. D., in the chair.

The minutes of the previous meeting were read and confirmed.

On motion it was resolved to add the subject of History to Section F.

The Rev. R. G. Boville, B. D., Rev. W. J. Dey, M. A., and C. O. Baker were elected members of the Association.

The Secretary read a brief report of the year's proceedings.

The Treasurer's report was read, which showed a balance of $63.53 in hand.

Mr. Gaviller, as Curator and Librarian, gave a report of additions to the library and museum during the past session, and Dr. Reynolds laid on the table the report of the Biological Section.

All these reports will be found in another place in this issue of the Proceedings.

The election of officers was then proceeded with, resulting as follows:

President, Rev. Samuel Lyle, B. D.
1st Vice-President, Dr. T. J. W. Burgess.
2nd Vice-President, W. A. Child, M. A.
Corresponding Secretary, H. B. Witton, B. A.
Recording Secretary, A. Alexander, F. S. Sc.
Treasurer, Richard Bull.
Curator and Librarian, Alexander Gaviller.

Council—J. Alston Moffatt, Dr. T. W. Reynolds, S. J. Ireland, B. E. Charlton, William Kennedy.

It was announced that a special section for Historical Study had been formed and would commence its meetings in September, and also that Mr. William Gibson, of Beamsville, had invited the Association to visit his quarries at that place during the summer.

After votes of thanks to the executive officers the Association adjourned to meet on the second Thursday of November.

HAMILTON ASSOCIATION.

SESSION 1887-88.

HOW TO STUDY BOTANY.

BY DR. T. J. W. BURGESS.

Read before the Association, 10th of May, 1888.

MR. PRESIDENT, LADIES, AND GENTLEMEN :—It is with feelings of pleasure mingled with fear that I find myself, for the first time, occupying a position as essayist before a general meeting of this Association. To feel that I have been considered worthy of being selected for such a task is an undoubted pleasure, but with that pleasure comes the haunting fear, that I may not be able to do credit to those who have so complimented me. An address, at such a meeting, is always looked forward to as an important event, and not unreasonably so, since the very fact of the speaker's selection should indicate ability to handle his subject in a suitable manner. Much more so is this the case when, as in the present instance, that speaker has had thrust upon him, most undeservedly I am afraid, the credit of being a specialist in the science selected for his discourse. True, if a penchant for that wonderfully fascinating study Botany, if an honest love for nature and nature's works constitute a specialist, I am one; but that I am especially well up in a knowledge of plant-life, especially well able to communicate what little knowledge I do possess to others, is open to grave doubt. I can assure you, however, that I appreciate the confidence shown in me, and will simply offer my hearty thanks for the honor conferred on me.

Botany is that branch of science, or of natural history, which comprehends everything relating to the Vegetable Kingdom. It embraces every scientific enquiry that can be made respecting plants; their nature, their kind, the laws which govern them, their distribu-

tion, and their economic uses. The science is divided into Physiological or Biological Botany, and Systematic Botany, the former dealing with plants in respect to their structure and functions, the latter in respect to their names and classification. Forming as it does, the foundation of the science, the study of plants should begin with Physiological Botany. But first a few words as to the value of botany as a training for the mind.

The highest and most important object of all human science should be mental improvement, and the study of natural history, in particular field-work, when properly pursued, is assuredly adapted to strengthen, discipline, and develop the mental powers. It robs the mind of contracted ideas, and teaches us to take close as well as comprehensive views of objects, and argue from facts not from fancies. Though the study of nature in any of her forms is calculated to bring about these results, none of the natural sciences is as good for beginners as botany, the materials being everywhere abundant and inexpensive. To the average student, plants, possessing life, are more interesting than minerals, while animals, though affording the most striking marks of designing wisdom, cannot be dissected and examined without painful emotions.

One of the most apparent of the many advantages to be gained by the study of botany is that it systematizes the mind, by imprinting on it and establishing habits of order and exactness. It thus gives all the benefits of mathematics or logic without the drudgery which debars so many from pursuing the study of these sciences. System is essential not only in science, but in conducting any kind of business and in the most trivial affairs of every-day life, thus the very logical and systematic arrangement prevailing in botanical science cannot but induce in the mind a habit and love of order, which, when once established, will operate in even the minutest concerns. The methodical habits of thought, by which alone plants can be properly examined, must necessarily be inculcated, and will prove invaluable in any vocation of life. Nor is it essential that the study (to be of use as a training for the mind) should be carried to any great length—we cannot all hope to be Grays or Darwins—the elements of the science alone are sufficient as a means for the practice of this training to habits of methodical thought.

The taking of notes in a neat and systematic way, by which

alone the results of examinations and discoveries can be recorded in a manner ready for reference, begets a concise style and an accurate use of exact words; while in the very collecting of material to form an herbarium the faculty of observation is cultivated and developed, and the power to discriminate between species, thus to appreciate minute differences, is obtained. Most important of all things to the botanist are these faculties of observation and comparison. Many persons have a natural acuteness in perceiving details of structure and in generalizing results, while others are very obtuse in such respects. Yet, in all, these powers can be cultivated and strengthened, and herein lies one of the great educational uses of botany, that it trains us to see and to think.

But in addition to the direct benefits to be gained by the study of botany, there are others of a more general nature, and man's great aim in life being the pursuit of happiness, I would place first the added pleasure it gives to life. To one not trained to an inquisitive appreciation of Dame Nature how comparatively few are the beauties she displays.

> "A primrose by the river's brim
> A yellow primrose is to him,
> And it is *nothing* more."

Very different is it when he has the slightest knowledge of botany. Then, in even the humblest of the vegetable creation, he can note the structure, take cognizance of the relationship borne by the several parts to each other, see the marvellous way in which each organ is adapted to serve a certain end, and in all admire and do homage to that All Wise Being at whose creative fiat all things first were made.

Last but by no means least of the advantages to be mentioned is, that the pursuit of the science, leading to exercise in the open air, is conducive to health and cheerfulness. Botany is not a sedentary study, which can be followed in the house, but one the love of which compels its devotees to seek their amusement out of doors, thus to breathe the pure air where the objects of their search are to be found; in the fields, along the winding brooks, on the mountain side, or in the cool depths of the forest. In every pursuit a certain amount of recreation and exercise is necessary for the maintenance of health, and walking is the means commonly employed to procure this. A walk taken merely as a duty is wearisome, but when indulged in

with a definite and pleasant end in view it becomes delightful. As soon as one in his rambles begins to search for and collect any special class of objects he becomes interested, and marvels how he could formerly have been blind to so much that is curious and beautiful. To those who know anything of outdoor life what a source of enjoyment it is to wander through the fields and woods. Each step brings some object of interest or some new discovery; a flower not hitherto noticed, or some familiar one showing variation from the common form; a rare bird flitting from branch to branch, or some brilliantly colored insect pursuing its erratic flight.

Of the value of botany as an economic study I shall say but little. None of you but recognize what an important part it plays in nearly all the arts and sciences. In medicine great discoveries have been made as to the value of certain plants in the cure of disease, and daily fresh discoveries are being made. Vegetables, fruits, and cereals are most important articles of diet, and great advances are to be made in the production of new varieties of these, while the study of the injuries done to them by the lower forms of vegetable life, such as fungi and rusts, presents an immense field for research.

During the past thirty years the method of teaching botany has undergone a radical change, and what is called "The New Botany" has sprung into vogue. As formerly pursued the study consisted mainly in learning from some book the names of the different kinds of roots, stems, leaves, and flowers. If plants were obtainable perhaps the scholar was made to run superficially over a few of them, and by aid of an artificial key determine their names. The terms were hard and unfamiliar and there were no specimens used to illustrate the lessons. Was it any wonder then that pupils acquired a disgust for the science? Little or no field work was attempted, and no thought was taken to promote habits of close observation, or to secure a knowledge of the mysteries of plant life. By the new system, the special design of which is the training of pupils to fit them for original work, objects are studied before books, and the student is at once set to investigating and experimenting for himself. Of this system an able exposition is to be found in a lecture, on the best method of teaching botany, delivered at a meeting of the Michigan State Teachers' Association, by Mr. W. J. Beal, Professor of Botany in the Agricultural College at Lansing. The title of the

paper, which was published in the Transactions of the 29th Annual Meeting, is "The New Botany," and it will well repay an attentive perusal. To give you an idea of the method pursued at Lansing I have made a short resume of it. Before the first lesson each pupil is furnished with, or told where to procure, some specimen for study. If it is winter, and flowers or growing plants are not to be had, each is given a branch of a tree or shrub. The examination of these is made by the pupils themselves during the usual time for preparing lessons, and for the first recitation each tells what he has discovered about his specimen, which is not in sight. If there is time each member of the class is allowed a chance to mention anything not named by any of the rest. If two members disagree on any point they are requested to bring in, the next day, after further study, all the proofs they can to sustain their different conclusions. In learning the lesson, books are not used, nor are the pupils told what they can see for themselves. An effort is made to keep them working after something which they have not yet discovered. For a second lesson the students review the first lesson,—report on a branch of a tree of another species which they have studied as before,—and notice any points of difference or of similarity. In like manner new branches are studied and new comparisons made. Time is not considered wasted in this. No real progress can be made till the pupils begin to learn to see; and to learn to see they must keep trying to form the habit from the very first; and to form the habit the study of specimens is made the main feature in the course of training. The use of technical names is not avoided, nor are these "thrust upon a student." They are learned as they are needed, a few at a time, from the teacher or a text-book. After from four to ten lessons on small branches, the following points, and many others, are brought out. Is there any definite proportion of active and dormant buds in any year? Where do branches appear? Is there any certain number of leaves in a year's growth, or any definite proportion between the length of the internodes? Is there any order as to what buds grow, and what remain dormant? etc., etc. The pupils are now ready for a book-lesson on buds, branches, and phyllotaxis, and will read it with interest and profit. In like manner any other topic, as roots, seeds, stamens, leaves, or petals is first taken up by the study of specimens. Very little stress is placed on investigating a number of chapters in the definite order as given in

a text-book. For example, it makes little difference whether a pupil begins with a study of petals or stamens, buds or roots, leaves or pistils; but it is desirable after begining any topic, not to abandon it till many of the various forms have been thoroughly studied. After a day, two, three, or more of study of specimens pertaining to one topic, comes the study of the book. Even in the shortest and most elementary course, a study of some of the specimens by all of the class precedes the study of the text. A young man of eighteen begins and pursues the same course as a child of ten, only he will progress faster and go deeper. As students advance in morphology and systematic botany, subjects for descriptive compositions, "Observation Papers," are assigned them, usually from one to three a term, of which the following will serve as examples. Each pupil studies the living plants for himself and makes his own observations, experiments, and notes, the only help afforded him being brief hints as to how to set to work intelligently. For instance,—one studies the arrangement and development of the parts of the flower with reference to its self-fertilization or fertilization by birds, insects, wind, or other means; one the vines of dodder; one the climbing of Virginia creeper; one the time of opening and closing of flowers; and so on ad infinitum. When completed the theses are read in the class-room. During five-sixths of the academic year, in which the students have daily lessons in botany, fully three-fourths of the time is given to the study of plants in some form or other, the books serving only for reference. But little time is occupied with lectures, short talks of ten, fifteen, or twenty minutes being occasionally given. In the whole course there is kept constantly in view how best to prepare students to acquire information for themselves with readiness and accuracy, in other words, they are trained more than they are taught.

I have been thus lengthy in my abstract of Professor Beal's paper as it most plainly sets forth the modern method of teaching botany. This, or some modification of it, is the system now most in repute, and wisely so. I agree with him fully, that the great object in teaching botany should be, to put students in the way of becoming independent and reliable observers and experimenters, and that the method of study pursued should be primarily objective and based upon the actual examination of the appropriate material. But while agreeing with him as to the end to be attained, I am not quite in accord with his method of attaining that end. To my mind, a cer-

tain, though slight, amount of knowledge gained by the old system is necessary before much can be accomplished by the new, and I would prefer, if teaching, to first of all give my pupils some idea of what plants are, how they grow, the nature of their structure, and the number of their parts. This to be done in a short series (five or six) of familiar talks, made as simple as possible, with each point illustrated by drawings, models, dried specimens, or, best of all, freshly gathered plants. Without some faint idea of plant life, to plunge a pupil headlong into the depths of the study, were to me like setting him to solve some abstruse mathematical problem prior to his learning the meaning of addition and subtraction. Mr. Beal, too, in his paper, whatever he may do in practice, makes no mention of a point which I deem of vital importance, viz., that every student in botany, from almost his very entry on the subject, should be urged to start and taught how to make an herbarium, or collection of plants, for himself. Field-work is of the greatest importance in promoting familiarity with habitats, and in solving most of the problems of plant-life, and to induce pupils to engage actively in field-work there is nothing equal to starting them to form an herbarium, for in no other way can such an interest be excited. In my experience, young people can best be stimulated to take an interest in any branch of study by giving them something to do in connection with it. Some striking examples of this have fallen under my observation in Philately, the modern rage for postage-stamp collecting. I have known those, to whom the study of geography was most irksome, led to take great interest in it by encouraging them to form a stamp collection. The questions naturally arising in their minds, on the obtaining of a stamp from any special country as to the whereabouts of that country, led to a desire for more extensive knowledge of it, and thus was laid the foundation of a love for geographical study. Nor is the interest excited, through collecting, in the general study of any science, confined alone to the young, students of all ages yield to its fascination and are thus led, often insensibly, to pry deeper into its mysteries. But it is not alone in the excitement of an interest in the study of botany that the value of an herbarium lies. The ultimate end of any scientific study being the mastery of all that can be learned concerning it, the formation of a collection of plants in a manner most convenient for reference is a necessary part of the science of botany.

But enough has been said to give you an idea of the general principles on which botany is now usually taught in colleges and schools. Let me next devote myself to telling you what I consider the best way for you to enter upon the study. The first step is to procure a text-book on structural botany. It matters little what this is. Gray's "How Plants Grow," Wood's "Object Lessons in Botany," Spotton's "Elements of Structural Botany," or Gray's "Lessons in Botany:"—any of them will answer, but for choice I prefer Gray's "Lessons." It is not too complicated and yet is extensive enough except for advanced students, who wish to devote themselves specially to the study. To such I would recommend Gray's "Structural," and Goodale's "Physiological Botany," Sach's "Text-Book of Botany," or Bessy's "Botany for High-Schools and Colleges." A work on systematic botany is also essential and the choice is large, though I know of none better than Gray's "Manual of the Botany of the Northern United States," which covers our Ontario Flora. I would advise any one purchasing to get the "Lessons" and "Manual" bound together. In this shape the books are not only cheaper but more handy, and we have in combination excellent works on both departments of botany, structural and systematic, no small desideratum to the beginner, who, in naming plants by the latter, will from time to time meet with unfamiliar terms for the meaning of which he will require to refer to the former. Spotton's systematic manual, "The Commonly Occuring Wild Plants of Canada," is a Canadian work and very good, but it is too meagre. Working with it, one runs the risk of occasionally spending long and patient labor trying to name a plant, only to fail because it is not mentioned, and I know no experience more likely to disgust the beginner than this. More extensive systematic works are Torrey and Gray's "Flora of North America," and Gray's "Synoptical Flora of North America."

A text-book secured, comes what is generally looked upon as a rather dry part of the science, viz., the reading of it. Many words are met with which are strange and difficult to remember, but let me say that the labor of learning technical terms is usually much over-estimated; with practice they soon become quite familiar, while the discipline taught the mind in acquiring them is worth all it costs. There is no royal road to solving the problems of nature any more than there is to deciphering the mysteries of mathematics or

metaphysics, but at each step the way becomes easier till at last what was a wearisome task becomes a pleasant and absorbing recreation. The so-called drudgery is greatly lessened if the reading be pursued in a proper manner, and especially if the reader has before him the proper material to illustrate the more important points in each topic as it is taken up. He, who has some older botanical head to advise him what material to provide beforehand for each chapter, is greatly blessed, but, whether he has specimens to examine or only the plates in his text-book to guide him, I would strenuously advise him to make no effort to commit all the terms he meets to memory. Let him try to read slowly and understandingly, but let him bear in mind that the object of this primary reading is only to get a general notion of plants and their parts, and to learn the meaning of a few of the most material technical terms, so as to be able to start collecting and naming plants for himself. Thus, in the first reading, he will gain an idea of the life history of a plant, and discover that as a rule a miniature plantlet, the embryo, exists ready formed in the seed. If now this seed, say that of the maple, be placed in the ground and allowed to germinate, the miniature plantlet will soon be seen to develop in two opposite directions; downward into a root or descending axis, and upward into a stem or ascending axis. The stem as it reaches the surface of the ground will be seen to bear a pair of narrow green leaves, the seed-leaves or cotyledons. Soon between these seed-leaves will appear a little bud, which shoots upward into a second joint bearing another pair of leaves, which, however, differ in shape from the first pair and resemble those of the maple as usually seen. Later, a third joint shoots up from the summit of the second, bearing a third pair of leaves, and so on until the plant likeness of the seed becomes a fully developed tree. The three organs, root, stem, and leaves, which existed in the embryo in a rudimentary state, are called the fundamental organs or organs of vegetation, because they have for their object the development and nutrition of the plant; while all the parts which succeed the leaves, such as the flower and its organs, are only modifications of them designed for a special purpose, and are called the organs of reproduction, since on them depends the increase of the plant in numbers, or the continuance of the species.

Proceeding onward with his reading he will obtain some general knowledge of the various sorts and forms of these two sets of organs.

For instance, regarding the organs of vegetation, he will learn the meaning of the terms annual, biennial, and perennial as applied to roots,—of herbaceous, shrubby, and arborescent as applied to terrestrial stems, and rhizome, tuber, and bulb to subterranean ones; he will remember the parts of the leaf, blade, petiole or leaf-stalk, and stipules, and the distinction between netted-veined and parallel-veined, simple and compound leaves; and he will discover that leaves are named, from their general outline, linear, lanceolate, ovate, cordate, etc., from their apex, acute, obtuse, truncate, etc., and, from the degree of their division, entire, serrate, dentate, incised, cleft, and divided, which last makes the leaf really a compound one. About the organs of reproduction he will learn the distinction between a raceme and a corymb, an umbel and a spike as applied to the inflorescence; will note that the parts of the individual flower are of two sorts, protecting organs and essential organs, the former consisting of the calyx formed of the sepals and the corolla formed of the petals, the latter of the stamens and pistils. He will also understand the meaning of and perhaps remember some of the names applied to different kinds of flowers, as complete when it has calyx, corolla, stamens and pistils, and incomplete if any of these organs, as they may be, are missing; perfect when it has both stamens and pistils, and imperfect when either of these is wanting; staminate when it possesses only stamens, and pistillate when only pistils; polypetalous when it has both calyx and corolla and all the petals are distinct, monopetalous when with the same organs the petals are all united, and apetalous when either calyx or corolla, or both, are absent; regular when all the sepals, all the petals, all the stamens, and all the pistils are alike, and irregular when any or all of them are unlike.

Having thus obtained some knowledge of the various sorts and forms of plants and their parts, the student will next, from his text-book, learn something of vegetable fabric, and get an insight into the life of plants and the mode in which they do the work of vegetation. He will discover that all plants possessing leaf-green (chlorophyll) as the pigment which gives the green color to the leaf is called, possess also the power of assimilation, that is of making starch and similar organic compounds out of inorganic elements, such as water and carbonic acid; which transformation, briefly speaking, is thus effected. The plant through its roots, by the process known as osmose, takes in, dissolved in water, various compounds

containing carbon, oxygen, hydrogen, nitrogen, potassium, and other materials. The pressure exerted by the liquid as it comes into the roots, together with the attraction exerted by a constant process of evaporation from the leaves, causes the "sap," which is the plant food, to rise, and gives us what is known as the plant circulation. When, by this osmotic action, the sap finally reaches the leaves, it, in conjunction with carbonic acid derived from the air, is converted, in the chlorophyll grains under the influence of sunlight, into organic materials, which pass into a whitish granular liquid called protoplasm, and are used in "growth," that is in the building of new cells to form plant tissue. Assimilation takes place only in sunlight, but growth goes on most rapidly at night. In the former process oxygen is set free and given off through the leaf-pores or stomata, but in the latter air is taken in through the stomata, and, as its oxygen is used up, carbonic acid gas is given off. It will thus be seen as tersely put by Mr. L. H. Bailey, Jr.,—"If the leaves are the lungs of the plant because they breathe, they are more emphatically the stomachs of the plant because they assimilate and digest."

It is now in order for the student to learn something of classification, as it is by this means he is enabled to analyze and recognize by name the plants with which he meets, thus to avail himself of all that has been recorded concerning them by botanists before him.

To the ordinary observer plants differ so much from one another that he can see no points of resemblance which could connect them naturally. For example, what likeness is there between the common strawberry and the mountain ash? Yet both belong to the rose family. Notwithstanding this great external dissimilarity, the botanist can readily point out in both, characters which at once stamp them as closely akin. The points which determine the relationship of plants are not confined to any one part of them; they may exist in the roots, leaves, flowers, or fruits, but the natural system now in use aims to bring together those which most closely resemble each other in all these particulars, laying especial stress on the flowers and fruit. In this respect it differs from the Linnæan and all other artificial systems, which took up a certain set of organs and based kindredship on those alone.

The means by which a plant reproduces itself and is prevented from becoming extinct is evidently its most important and essential

part, and it is on this, the fruit, that the vegetable kingdom is primarily divided, viz., into flowerless or cryptogamous plants, such as ferns, mosses and fungi, and flowering or phænogamous plants, such as herbs, shrubs and trees. The former reproduce themselves by means of spores, which are commonly simple minute cells and contain no embryo; the latter by seeds, which are embryo plantlets enclosed in an integument. The greater part of the flowerless plants, which are by far the most numerous, are as yet very imperfectly understood, and, on account of this imperfect knowledge as well as the fact that their study, which often requires the use of a good microscope, is very difficult, we will exclude them from our consideration. Confining ourselves then to flowering plants, we find that increase in diameter forms the first basis of division. There are two general methods in which this increase takes place. In the one case, the woody tissue is scattered as separate threads throughout the whole stem, and the increase in diameter is by the interspersion of new woody threads which stretch its surface; while in the other case, the woody tissue is all collected so as to form a layer between a central cellular part, the pith, and an outer cellular part, the bark, and the increase in diameter is by the addition of new layers of wood beneath the bark. The former class of plants, which includes our grasses, sedges and lilies, is called endogenous or "inside-growing;" while the latter, which includes all our northern trees and shrubs and most of our herbs, is known as exogenous or "outside-growing." In Canada the endogens are all herbs with the single exception of Smilax, but in warm climates they are largely represented by the palms. It is not, however, only the manner of growth that separates these two great divisions of flowering plants; marked distinctions exist in the seeds, flowers and leaves. The seeds of endogens contain but one seed-leaf or cotyledon, while those of exogens have two or more, the former are therefore said to be monocotyledenous, the latter dicotyledenous; the parts of the flower in endogens are usually in threes or multiples of three, while in exogens they are never in threes, but usually in fives or multiples of five; the leaves of endogens generally have the veins running parallel to the midrib, that is they are parallel-veined, while those of exogens are netted-veined. Excluding the endogens, which form only twenty-one of the one hundred and twenty-eight orders given in Gray's "Manual," we find that the exogens are subdivided into three

divisions based upon the character of the protecting organs or floral envelopes; viz., Polypetalæ, which have both calyx and corolla, and the petals not united with each other; Monopetalæ or Gamopetalæ, which have also both calyx and corolla, but the latter is composed of more or less united petals; and Apetalæ, which have no corolla, the floral envelopes being in a single series, or sometimes wanting altogether. The pine family (Coniferæ) belongs to the exogens, but as it forms part of a group represented in Canada only by itself, it is not included in either of these three divisions. Each of the divisions is again divided into natural orders or "families," which in turn are composed of genera, made up of species. The orders are large groups of closely related genera, while the genera are assemblages of species, which have a general similarity of fruit, flowers, leaves, and habit. The families and genera are so numerous, and so generally only distinguishable by a combination of marks that the points on which they are founded must be sought for in your text-book; the orders in the analytical key at the beginning of the work, the genera in the work itself at the beginning of the orders. To give you a more comprehensive view of it, the system of classification may be thus tabulated.

- Vegetable Kingdom
  - Cryptogams
  - Phænogams
    - Endogens—Orders—Genera—Species.
    - Exogens (Exclusive of Coniferae.)
      - Polypetalae—Orders-Gen.-Spe.
      - Gamopetalae-Orders-Gen.-Spe.
      - Apetalae—Orders—Gen.—Spe.

To illustrate the method of applying the system of classification to the naming of plants, let us suppose the student to have found the wild strawberry, which is now in flower, and that it is unknown to him. He sees that it is a flowering plant and must first determine whether it is endogenous or exogenous. The netted-veined leaves and the fact that the parts of the flower are in fives show it to be the latter. It is evidently not a pine, so that it must belong to the polypetalæ, gamopetalæ, or apetalæ. Both calyx and corolla are present so that it cannot be to the last, and the petals being all distinct it must be to the first. Turning now to the analytical key we find polypetalous exogens to be divided into three classes, marked A., B., and C., according to the number and position of the stamens. In A. the stamens are more than twice as many as the petals; in B.

they are of the same number as the petals and opposite them; and in C. they are not more than twice as many as the petals, and when of the same number are alternate with them. Our plant has the stamens numerous and so must come under the first class. This section, A., has two subordinate headings marked 1 and 2; the former includes species with the calyx entirely free from the ovary, the latter those where it is more or less coherent. The calyx being evidently free, the plant we are examining must belong to No. 1. This has several divisions regulated by the pistils, and by careful comparison of the plant with the key we find that it falls under the one headed, "Pistils more than one, separate and not enclosed in the receptacle." This division is again split up according to the point of insertion of the stamens, and the specimen having them fixed on the calyx clearly belongs to the order Rosaceæ. Turning now to this order we find it to be made up of three suborders, and a very little consideration will show us that the name we are looking for must be in suborder II, known as Rosaceæ proper. In this class there are three tribes formed chiefly on the number of pistils, and they being numerous our plant is certainly in the third. Reviewing the genera composing this tribe we soon settle that it can be only a Fragaria, and so pass on to this genus, which we see is made up of three species. By comparing our specimen with the characters of each of these we decide, and rightly so, that it must be Fragaria Virginiana.

This analysis, or naming, of plants, I have no doubt, seems very tedious and difficult to most of you, but, believe me, such is not really the case. After a few analysis the primary steps can be passed rapidly over, and I will guarantee that any one who will conscientiously study out twenty or twenty-five good examples will afterwards experience little difficulty in naming most of our flowering plants. Be not discouraged at the slow progress you will at first make; each successful analysis will facilitate the next, and very soon it will become so that when you have worked out one species of a genus you will be likely to know others when you see them, and even when plants of a different genus of the same family are met with, you will, ere long, generally be able to recognize their order at a glance from the family likeness. A capital practice for the beginner is to work out, in the manner I have indicated, a few plants with whose names he is already familiar. Success in these attempts

will naturally inspire confidence in the determination of plants previously unknown.

By his initial reading over of his text-book the student has got some knowledge of plants and plant-life, as well as an insight into the manner in which their names are determined. He is like the race-horse to which the jockey has just given a preliminary canter that he may "feel his legs" preparatory for his true task, the race, which lies before him. The knowledge he has gained is slight I grant you, but he is not quite in the dark. A foundation has been laid upon which it now becomes his duty to raise a creditable superstructure; a superstructure, the first step toward which should be the commencement of an herbarium, which, however, should be subservient to, or a co-partner with, the highest aim in botanical science, the elucidation of the mysteries of plant-life. Laying such stress as I do on the formation of a collection as an aid to further study, let me for a little call your attention to the advantages to be derived from having one, and the best appliances and methods for accomplishing this.

The use of an herbarium is, in general terms, to have constantly on hand material for study in any class of plants, for, by soaking them in water, dried specimens can be studied almost as easily as fresh. In no other way can we see simultaneously specimens of neighboring species, different states of the same species, and specimens of a species from different localities; and some of the brightest theories on the distribution of plants have been worked out by the aid of the "hortus siccus" or herbarium. The nomenclature and classification of objects can be best acquired by the constant handling of them, and the price of a good herbarium is incessant vigilance in warding off the attacks of insect pests. But in this vigilance what a throng of pleasant memories is perpetually being called up; the time and the locality, the surroundings, and, if you were not alone when gathered, your companions. Each specimen represents so much information, and the very mention of its name will recall to mind associations connected with its study. These results from the possession of an herbarium have been so beautifully set forth by Professor Bailey of Brown University, that I cannot refrain from quoting his words on the subject. "In looking them over one sees not alone the specimens themselves, but the locality in which they

were gathered. Many an incident of his life, the memory of which has long since become dormant, will be re-awakened as by an enchanter's wand. He will thread the forest paths gay with flowers; he will pause in imagination for the nooning by some fern-laced spring; he will climb the mountain ravine where the blood-root and orchis bloom; or wander, full of speechless yearning, by the ocean shore. Not only do the natural scenes return thus vividly, but the faces of friends who enjoyed the occasion with him. He is once more seated, may be, by a little lake on the mountain, in a garden of alpine flowers. Cool streams flow by him, and he picks the tart fruit of the cowberry. The world lies mapped at his feet, and the infinite heaven is above him. He hears the merry jest and ringing laughter, and his heart becomes gay with the thought of those old-time rambles."

A collector's outfit, which will answer all ordinary purposes, is cheap, and most of it can be got or made at home. It consists of a botanical box or vasculum; a plant-press or portfolio; a pocket lens; a trowel; a sharp jack-knife; and a note book. The clothing worn in collecting should be strong, as one often has to make their way through a tangle of thorny bushes, and old, so that no nervousness at fear of spoiling it may be excited. For foot wear stout shoes are generally recommended, but I prefer the oldest and easiest pair I have, with plenty of holes in them. One occasionally has to wade through a swamp where the water comes above the tops of any ordinary boot, and it is much better that it should run out freely as fast as it enters, than to have to sit down, take off and empty one's shoes, or continue to walk with the water sogging about in them.

The vasculum, which is most useful for holding specimens that are to be examined fresh, is of tin, and varies greatly in shape. The form usually adopted is that of a compressed cylinder, with a lid opening for nearly the whole length of one side. It is generally about 18 or 20 inches long, and has a light strap to throw over the shoulder. Any easily portable box will answer the purpose, but of late years I have entirely abandoned the vasculum, putting my specimens directly into the press, and carrying in my pocket an old newspaper or two, in which, previously dampening it, I loosely wrap up any plant that I wish to make special examination of.

Plant-presses or portfolios are of various kinds. The one that I use, and which has done good service from Cape Breton to

British Columbia, is made of quarter inch basswood strengthened by four cleats, and is 18 inches long by 11½ inches wide. The straps are provided with a cross piece, like a shawl-strap, which prevents them becoming separated when the press is open, and also serves for a handle to carry it by. If desired, a shoulder strap can also be attached. Wire presses and those of lattice wood-work are highly recommended by some, the advantages claimed being lightness and a free escape of moisture. In wet weather, however, the ordinary form has the great merit of keeping one's paper dry. For an excursion the press should contain a good supply of specimen sheets and driers with one or two pieces of mill-board or thin deal, all of them a little smaller than the press. Any thin, cheap paper will answer for specimen sheets. What is known as printing paper is the kind I ordinarily use. For driers a special paper is manufactured, but it is expensive, and I substitute "filter paper," which is obtainable at most druggists. Blotting paper of any kind will do, and, if economy be an object, old newspapers can be made to serve. Some of the finest and most beautiful specimens I have ever seen were turned out from newspapers alone. The object is to have a medium that will quickly absorb moisture and as quickly part with it again. The mill-boards or deals are to keep apart the damp papers containing the plants and the dry unused ones. I also usually carry in my press a few sheets of cotton-batting to lay over ripe fruits, such as strawberries or raspberries, to prevent their receiving too much pressure and so getting crushed out of shape.

A pocket lens should always accompany the collector, and should not be of too high power. A very powerful lens, while magnifying greatly, inconveniently narrows the field of vision and shortens the focus. An instrument of an inch to an inch and a half focal distance is to be preferred for field work. For ordinary housework a focussing lens with legs is very useful, or better still, the "Botanist's Microscope," the price of which is about $2. It is provided with a couple of needles mounted in handles and a pair of tweezers for dissecting purposes. To save expense its glass can be carried in the pocket as a field lens. For advanced work on the Cryptogams and for physiological botany, one of the many good microscopes now offered for sale will be necessary.

The trowel, which is used for taking up plants by the root, is generally replaced by a strong knife, as being more portable. A stout table-knife sharpened at the point will answer every purpose.

A sharp pocket knife cannot be dispensed with in trimming woody specimens, slicing tubers and stems, etc.

The note book is an object of prime importance and should be of such a shape as to be readily carried in the pocket. It should have a place for a pencil and a pocket to hold some slips of paper for field-labels. In this book should be jotted down any observations one cannot trust to memory, e. g., the color of flowers, the height of plants, the character of the soil in which they grow, the association of particular plants or insects, etc., etc. Unless the collector takes field-notes he will run the risk of letting important observations escape him, and he cannot too soon learn to make them in a concise, systematic, and legible way, never mixing up conjectures with actually observed facts. Everyone is prone to get into a hurried way of making notes, under the idea that they are for his own use only, and that he will readily recollect the rest of the facts omitted at the time. This is a great mistake and one that the student must carefully guard against. Notes are not often required immediately after being made, because every circumstance connected with the subject is fresh in the memory. But it frequently happens that a long time after, weeks, months or years, in pursuing some branch of study, the exact facts then observed are required; and I know nothing more disappointing than, on turning to one's note-book for the record of some experiment or observations, to find that at the time, trusting to memory, some of the details had been omitted.

In collecting, when a number of plants of which specimens are desired are discovered, the first thing is to make a judicious selection. To be really valuable the specimens in a collection should be as perfect and characteristic as possible, so that any one referring to it can learn full particulars about each species. A perfect specimen comprises all that is necessary for complete botanical investigation; leaves (both mature and immature, cauline and radical) flowers and fruit. Specimens can often be secured showing both flowers and fruit on the same plant, or fruit may be found on more advanced plants at the same time. If not in fruit it must be collected in this condition later in the season. The same rule applies to the obtaining of specimens with different leaves, or leaves in different stages, and it may require several seasons to make a complete specimen. The plant should be so arranged as to be no larger when dried than can be readily mounted on the herbarium paper.

Of small herbs, the whole plant, root and all, should be taken, but in every case enough of the root should be collected to show whether the plant is annual, biennial or perennial. Large plants may be doubled into a V or N shape. Thick stems, roots, bulbs or tubers can be divided and thinned down. The name of the plant if known, but always the locality and date, should be written on a field-label and put with the specimen into the press. A specimen of unknown date and locality loses much of its value and interest. My method of using the plant-press is this ; having picked a specimen or specimens I open my press and on the blank side lay a couple of driers, on these a specimen sheet, and on this a plant followed by a drier. This process is continued, alternating plants and driers, till all I have gathered are in. On the last drier I put one of my thin boards, and on this my dry papers, close my press, and start on the search for fresh objects of interest. In the case of very delicate plants, as many ferns, a specimen sheet should be placed above as well as beneath the specimen, in which sheets it remains until perfectly dry. The object of the double specimen sheet, which is not necessary with ordinary plants, is to prevent the delicate leaves from doubling up or becoming displaced in changing the driers. Care should be taken to display the specimens neatly, if possible showing both sides of the flowers and leaves, though in some cases it is easier to spread out the leaves and remove creases after a night's pressure has somewhat subdued their elasticity. Morning is the best time to collect most flowering plants, as many close their blossoms by noon, but those that open in the evening, Vespertine flowers, should be gathered at that time.

The actual pressing and drying of specimens is done at home in the ordinary field press or a similar but stouter one. A couple of pieces of inch board will answer every purpose. The pressure is made by screws, straps or weights, the latter being preferable, as under them the press follows the shrinkage of the plants. Half a dozen bricks, tied together with a cord strong enough to lift them by, makes a capital weight. Specimens should be put into the drying press as soon as possible after gathering, but often on returning from an excursion one is too tired to care for more labor, and I commonly leave mine in the field press until next morning, nor do I find them suffer any harm from so doing. The thin sheets (specimen sheets) containing the plants are transferred to fresh driers, heated in

the sunlight or by a stove, and remember always, *the hotter they are the better.* Be careful to place the specimens in such a way that one part of the bundle is not materially thicker than the other, by placing them on alternate sides, or putting in wads of paper if necessary. Plants dry best in small piles, and for dividing up a package if too large, or for separating the lots put into the drying press on different days, use thin deals like those taken out in collecting. When transferring to the home press be careful to remove all folds of the leaves and petals, and arrange the specimen as naturally as possible. The elasticity so troublesome in many plants when first gathered, will have in great measure disappeared, and the parts will stay as arranged. Some very succulent plants, and others with rigid leaves, such as stone-crops and pines, dry better if plunged for a moment into boiling water ere being put into the drying press. Every day, or at first even twice a day, the plants in their specimen sheets are to be shifted into fresh hot driers, the moist ones taken off being spread out to dry in the sun or by a fire, that they may take their turn again at the next shifting. The more frequently the plants are changed the better will they retain their color. After the first three or four days the changes need only be made every other day until the specimens are thoroughly dry and no longer moist or cold to the touch. The drying usually occupies from a week to ten days, but varies according to the succulency of the plants, the state of the weather, the frequency of the changes, and the degree of heat of the driers. The most convenient place for changing plants if it can be managed is a table beside a good hot range or stove, the top of which is free for use. If a damp drier be laid flat on the hot metal, steam at once begins to rise from it, and the moment it ceases to do so the paper is dry; leave it yet for a second until it becomes so hot as to be barely touchable with the naked hand, then lay it quickly on a specimen previously moved from the damp pile, and continue thus until the whole lot is changed. This plan is invaluable when driers are scarce, as sometimes happens on a botanizing trip, for by it the same driers, no matter how wet, can be used again immediately. A plan adopted by myself a few years ago, while collecting in Nova Scotia, might be mentioned as worthy of remembrance should any of you ever be placed in similar circumstances. Though not to be recommended for common use, as the specimens fall short of those obtained by the ordinary method, yet, if so situated that an abun-

dance of driers is not obtainable, or if the weather be so foggy and wet that they cannot be properly dried, it will be found of great practical value. On the trip referred to a large number of specimens had been collected, but so bad was the weather from rain and sea fogs that there was great danger of losing them all. Under these circumstances the thought came to me to take advantage of occasional glimpses of sunshine in the following way; each sheet of specimens was placed between two driers, which were spread in a single layer on the floor of an open balcony exposed to the sun. Pieces of board, logs, or bark placed in the sun would of course answer the same purpose. Small stones placed on the corners of the sheets prevented the wind disturbing them, and no pressure was used except the weight of the single drier covering them. An hour of good sunshine served to fully cure most plants. The plan is only applicable to specimens previously somewhat wilted in the press, as the leaves of fresh or insufficiently wilted ones curled up in the absence of pressure.

A collector's work does not cease when his specimens are dried. Plants are subject to the attacks of insects and it is therefore necessary to poison them in some way. The best protection is corrosive sublimate dissolved in alcohol, which is applied lightly to the specimens with a soft brush. It should be done as soon as the plants are dried, care being taken afterwards to leave them spread out until the alcohol has evaporated. The formula I use is:

Corrosive sublimate, . . .	1½ drachms.
Carbolic acid, ...	1½ drachms.
Alcohol, ...	12 ounces.

All the work hitherto done, the collecting, drying and poisoning, is but the preparation for the formation of an herbarium, the specimens in which should be fastened on half sheets of stiff white paper, either by slips of gummed paper or by glue applied to the backs of the specimens themselves. For a few cents a supply of white gummed paper, sufficient to last for years, can be purchased at any printing establishment. A narrow slip of this is cut off, moistened with the tongue, and placed over the part of the plant to be fixed down. The advantage of this process over actually glueing the specimens to the paper is, that in case the plant has to be removed for examination or any other purpose these slips can be easily lifted.

In mounting plants care must be exercised to keep the pile forming each genus and order as nearly level as possible by scattering the specimens over the sheets instead of placing them all exactly in the centre. If the plants are small put some at the top of a sheet, some at the bottom; some at the right side and some on the left, occasionally, in the case of large specimens, reversing them, so as to have the thick stems and roots at the top. In no case should more than one species be put on the same sheet, but, if small, two or more specimens of the same species may be so placed. The sheets for the herbarium should all be exactly the same size, which size is a matter of personal choice. I would, however, advise anyone starting a collection to adopt what is known as the standard size, from its being the one used in the public herbaria of the United States. This size, 16½ x 11½ inches, experience has determined to be the best. The advantage in adopting it lies in the fact that specimens are now generally made with a view to being mounted on such, and when any other is selected, in exchanging, plants not suitable in size are often received. My own sheets, I am sorry to say, are smaller than this, being only 15½ x 10 inches, but my collection was started and had grown to such a size before this standard was adopted that to change it all would have entailed great labor and expense, so I have considered it advisable to continue as I began. The Linnæan herbarium is on paper of the common foolscap type, but this is much too small. The generic and specific name of the plant, the name of the botanist who bestowed it, the habitat, place where collected, date of collection, and name of collector should be placed at the lower right hand corner of each sheet, either written on the sheet itself or on a label attached there, the latter being the usual and better plan. These labels vary according to taste, but the points desirable of observance are clear type, neatness and simplicity. They should not be too large nor yet too small. The late Dr. Gray recommended one 2 x 4 inches. At the top of the label is usually printed the word Herbarium, followed by one's own name, and in sending away a specimen to anyone, there should be written on the label, which must invariably accompany it, in front of this word, the Latin prefix ex or its English equivalent from, to show who was the sender. On receiving a specimen the accompanying label should always be mounted with it. My own practice when given a specimen is to put the donor's label in the customary place

and my own name, of which I keep a supply on gummed paper, at the lower left hand corner. Some attach their labels permanently with paste or by having them printed on gummed paper, but I prefer to merely fasten them lightly at the sides, thus allowing their removal should it ever be necessary to transfer the specimen to another sheet. All the sheets containing plants of the same genus are placed in genus covers, which are full sheets of stout, colored paper, that when doubled measure about a quarter of an inch more in width than the herbarium sheets. The name of the genus is written at the bottom of the genus cover, either in the middle or at the left hand corner, or sets of printed genus labels can be purchased cheaply and one of these pasted on instead. For convenience in reference the names of the contained species may be written in pencil on the genus cover, the reason for using a pencil being that this list is liable to constant change. The various genera are arranged systematically, or for greater convenience alphabetically, under the order to which they belong, and laid flat in large pigeon-hole compartments in a closed cabinet, or else placed in portfolios, which stand upright like books in a bookcase, with the names of the contained orders lettered on the back, or on a tag attached to the portfolio. The herbarium is made complete by a list or catalogue of the plants it contains, by referring to which one can at any moment tell what species are represented.

Having thus described the method of collecting and preserving specimens, let us briefly consider what may be called the second step in the study of botany, viz., excursions; the first, as already stated, being a preparatory reading over of the text book. The object of collecting excursions should be threefold: 1st, to cultivate habits of observation and secure knowledge of habitats and the growing appearances of plants; 2nd, to gather specimens for the herbarium; 3rd, to secure material to work on during a second and more thorough study of structural botany. Each division of the text-book should now be taken up and studied until the subject-matter is firmly fixed in the mind, the requisite material for the complete illustration of each chapter by actual observation being gathered on an excursion prior to commencing it. Even in the winter season excursions should not be entirely abandoned; the true naturalist can always find something to admire and much useful work can be done

in observing the trunks, branches and buds of trees and shrubs. Winter is, however, the time pre-eminently fitted for herbarium work, preserving, mounting, labelling, cataloguing, and, if the necessary appliances are obtainable, laboratory work with the microscope.

The best place to begin collecting is where you live. Be your abode where it may there are surely some plant rarities near it, and the first goal to struggle for is a thorough knowledge of the resources of your own vicinity. When you have made a special study of the plants there you may easily extend your researches. If on your excursions you can have the company of some older botanist so much the better, since from him you can get the names of the plants you gather and the prominent characters on which the naming is founded. I would, however, strongly advise you always to take home one or two unnamed specimens, on which to practice analysis, for it is only by such practice you can ever become so familiar with the orders as to be able to, pretty nearly, locate strange ones at a glance. The accumulation of a mass of unnamed plants is to be avoided, lest a pleasant task become a wearisome labor, inspiring only disgust. Make it a rule to get your specimens named as soon as possible. If you have no one near to whom you can show them, enter into correspondence with some botanist and arrange with him to name the packets you may send him from time to time. You need not fear that your letter asking the favor will be unanswered. The wonderful spirit of fellowship, comradeship if I may call it so, existing among scientists, and evinced by their willingness to lend a helping hand to even the humblest votary, is to me one of the greatest charms in scientific pursuits. But here a word of warning,—never send scraps of plants to be named, for though a good botanist can often identify them, it is unfair to ask him. His time is too valuable to be spent in guessing riddles. Courtesy also demands that in all correspondence the seeker after information should enclose stamps for return postage. In collecting a specimen for yourself, if it be at all rare, always, if possible, gather duplicates to be used in exchange. Under no consideration, however, obliterate a rare species from any locality, and do not even make its whereabouts known to any except true lovers of the science. There are vandals, who, through mere vanity, would not hesitate to destroy the last survivor of a species; nor would they do it only unthinkingly. From the duplicates of the best things around you a large

variety of plants can be got by exchange, and the pleasure and profit in making a collection is largely due to the intercourse thus brought about with those of kindred tastes. Nor is this confined to those in your own country; it is often necessary to have certain specimens from other regions, and you are thus brought into correspondence with scientists in all parts of the world. Let your specimens be well made, and never send away a poor one unless it be of something very rare. A man soon becomes known by his exchanges, and if his specimens are poor he is made the subject of much unpleasant criticism and will in time be avoided by all good collectors. Always preserve the choicest specimen collected for your own herbarium, but after this send the best you have to the first correspondent who asks for it. Keep even a fragment of any species not represented in your collection until you get a better, but of your duplicates destroy any too poor to send away. Do not hoard up duplicates. The man who studies science for science's sake would sooner give away every specimen for nothing than allow them to remain buried like a miser's gold. Make sure that all plants you send out are correctly named, and notify your correspondent whether they are poisoned or not. Never promise a plant unless you actually have it or are positively certain of being able to get it, and keep a catalogue of your duplicates that you may be prepared at all times to answer a brother collector who applies for anything.

The last stage in botanical study, and the one to which all others should be only stepping-stones, is the working out of some of the many unsolved problems of plant life by independent and intelligent observation and experiment. The breadth of the field for exploration by original observation is immense, as comparatively little is known of the laws governing many of the phenomena of plants. For example, little is known of the hosts of some of our parasitic plants, and in some cases it is even disputed whether certain plants, commonly considered such, are parasites at all; though all plants move more or less, we possess scanty knowledge of the nature of this movement in many of them, and still less of its object; we know that cross-fertilization is generally necessary for the production of perfect seed, but in many cases we do not know the particular agents that perform the work; we are aware that cleistogene flowers produce pods far more fruitful than the ordinary blossoms, but we know almost

nothing about the proportion of the kinds, or why a plant should be provided with two sorts of blossoms. There are many other points just as vague, hints as to which may be found in snch works as Darwin's "Climbing Plants," Bailey's "Talks Afield," Prentiss' "Mode of Distribution of Plants," and Kerner's "Flowers and their Unbidden Guests." Enough, however, has been said to show that the way to discoveries new to science is open to even the youngest student There is practically no limit to the papers that could be prepared by any of you for this or similar societies; papers both interesting and useful; papers of value to the scientific world at large; papers that any of our scientific journals would be only too glad to find room for. And here, in conclusion, I would say, that if within his means, and they are very cheap, no student of botany should neglect to take at least one of the periodicals devoted to the science. The "Bulletin of the Torrey Botanical Club," the "Botanical Gazette," and the "American Naturalist," are among the best. The first two are devoted entirely to botany, the last takes up other sciences as well.

If I have trespassed too much on your time, or wearied you with my effort to give an idea of how I think botany can best be studied, I pray you pardon me. Each of you who takes up this beautiful science will, I have no doubt, see modifications that you may think might be advantageously made in the method suggested. Should it be so by all means adopt them; the method employed is of little importance provided only it brings about the great aim and end of the study, which is to learn to observe and compare. Do this honestly and you cannot fail to become lovers of nature, and, being lovers of nature, better and happier men and women, men and women in some degree approaching that illustrious scientist of whom was said;—

"And Nature, the old nurse, took
The child upon her knee,
Saying: 'Here is a story-book
Thy Father has written for thee.'

"'Come, wander with me,' she said,
'Into regions yet untrod;
And read what is still unread
the manuscripts of God.'

"And he wandered away and away
With Nature, the dear old nurse,
Who sang to him night and day
The rhymes of the universe.

"And whenever the way seemed long,
Or his heart began to fail,
She would sing a more wonderful song,
Or tell a more marvellous tale."

EARLY HISTORY OF THE IROQUOIS.

BY DR. DEE.

(A Paper read before the Hamilton Association.)

The Iroquois achieved for themselves a more remarkable civil organization and acquired a higher degree of influence than any other race of Indian lineage excepting those of Mexico and Peru. In the drama of European colonization they stood for nearly two centuries with an unshaken front against the devastations of war, the blighting influence of foreign intercourse, and the still more fatal encroachments of a restless and advancing border population. Under their federal system, the Iroquois flourished in independence and capable of self protection long after the aborigines of New England and Virginia had surrendered their jurisdiction and fallen into the condition of dependent nations, and they now stand forth upon the canvas of Indian history, prominent alike for the wisdom of their civil institutions, their sagacity in the administration of the League, and their courage in its defence. When their power and sovereignty finally passed away, it was through the events of peaceful intercourse gradually leading to this result, rather than conquest or forcible subjugation. They fell under the giant embrace of civilization, victims of the successful warfare of intelligent social life upon the obstacles of nature, and in a struggle which they were fated to witness as passive and silent spectators. There is no connected history of the rise, progress and decline of this Indian league.

At the era of Dutch discovery (1609), the Iroquois were found in possession of the same territories between the Hudson and the Genesee rivers upon which they afterwards continued to reside until near the close of the eighteenth century. At that time the five nations into which they had become subdivided entered into a

league; but its formation was subsequent to their establishment in the territories out of which the State of New York has since been erected.

Their remote origin and their history anterior to the discovery, are both enshrouded in obscurity. Tradition interposes its feeble light to extricate from the confusion which time wrought, some of the leading events which preceded and marked their political organization. It informs us that prior to the Adirondacks, a branch of the Algonquin race, then in possession of the whole country north of that river, the Iroquois were but one nation and few in number. From the Adirondacks they learned the art of husbandry, and while associated with them, became innured to the hardships of the chase and the warpath. After they had multiplied in numbers and improved by experience, they made an attempt to acquire the independent possession of the country they occupied, but having been in the struggle overpowered and vanquished by the Adirondacks, they were compelled to retire from the country to escape extermination. The period of their migration from the north cannot now be ascertained. Tradition informs us that having ascended the St. Lawrence to Lake Ontario and coasted along its eastern shore to the mouth of the Oswego River, they entered through this the central parts of New York. Their first settlements, they believe, were located upon the Seneca River, where for a time they dwelt together. At a subsequent day they divided into bands and spread about to found new villages. One, crossing over to the Mohawk, established itself at Ga-ne-ga-ha-ga, below Utica, and afterwards became the Mohawk nation. For some years the Oneidas and Onondagas were one nation, but one part of it having become established at Ga-no-a-lo-hale, east of the Oneida lake, in time became independent, while the other planting themselves in the Onondaga Valley and on the hills adjacent became a separate nation. In like manner, the Cayugas and Senecas were long united, and resided upon the Seneca River; but one band of them having located themselves upon the east bank of the Cayuga Lake, grew up in time into a distinct nation, while the residue, penetrating into the interior of Western New York, finally settled at the head of Canandaigua Lake and there formed the nucleus of the Seneca nation.

The Onondagas have a legend that they sprang out of the ground on the banks of the Oswego river; and the Senecas have

a similar legend that they sprang from the ground at Nun-da-wa-o at the head of Canandaigua Lake.

These several bands were at first obliged to contend with the various tribes whom they found in possession of the country. After their expulsion, the interests and pursuits of the five nations not only became distinct, but the severance was followed by a gradual alienation, finally resulting in a state of open warfare, which continued for an unknown period.

The project of a league originated with the Onondagas, among whom it was first suggested as a means to enable them more effectually to resist the pressure of contiguous nations. The epoch of its establishment cannot be decisively ascertained, although the circumstances attending its formation are still preserved with great minuteness. These traditions all refer to the northern shore of the Onondaga Lake as the place where the Iroquois chiefs assembled in general congress, to agree upon the terms and principles of the compact by which their future destinies were to be linked together.

It is evident from their traditionary history, which is entitled to considerable credit, that they long occupied the country before their necessities or increase of numbers, made the league a possible or desirable consummation.

In relation to the period of its origin, there are some circumstances connected with their first intercourse with Europeans, tending to show that it had subsisted about a century at the era of Dutch discovery; on the other hand their traditions indicate a period far more remote.

After the formation of the League, the Iroquois rose rapidly into power and influence. It gave them additional strength, a constant increase of numbers, and a firmer establishment, through their more ample means for self protection and foreign conquest. One of the first results of their federal system was a universal spirit of aggression, a thirst for military glory and political aggrandisement, which made the forests of America resound with human conflicts from New England to the Mississippi and from the northern confines of the great lakes to the Tennessee and the hills of Carolina. Unrecorded except by tradition is the narrative of the achievements of this gifted and progressive race, who raised themselves through the vicissitudes of incessant strife to a general and acknowledged supremacy over these boundless territories.

Without considering the terrible and ferocious characteristics of Indian warfare, it must be admitted that the empire which they reared over Indian nations furnishes no slight evidence of their hardihood, courage and sagacity.

With the first consciousness of rising power they turned their long cherished resentment upon the Adirondacks, who had oppressed them in their infancy as a nation, and had expelled them from their country in the first struggle for supremacy. This war raged for a long time with increasing animosity, and was continued for nearly fifty years after the commencement of French occupation, until the ancient Adirondacks were almost totally extirpated. At the era of French discovery (1535) the latter nation appears to have been dispossessed of their original country, and driven down the St. Lawrence as far as Quebec. When Jacques Cartier first ascended this river in 1535 the country about Quebec was in the possession of a people speaking the Algonquin language, doubtless the Adirondacks, while the site of Montreal was occupied by a nation speaking the Huron language, of which the language of the Iroquois is a branch. After the permanent occupation of Canada by the French in 1607 the Adirondacks became their allies, but the protection of the former was insufficient to shield them against the hostile visitation of their hereditary enemy.

A new era commenced with the Iroquois upon the establishment of the Dutch trading post at Orange, now Albany, in 1615. At this time the Iroquois had grown up into a powerful and populous confederacy, had conquered several of the surrounding nations, and were rapidly advancing to a general supremacy in the northeastern section of the continent.

No Indian race east of the Mississippi had reached such a position of authority or influence or were bound together by such enduring institutions. Firmly established upon the territory of New York and above the danger of displacement from adjacent nations, they had already entered upon that career of conquest which they afterwards prosecuted with such signal success.

Friendly relations were establithed between the Iroquois and the Dutch, which continued without interruption until the latter surrendered their possessions upon the Hudson to the English, in 1664. During this period a trade sprang up between them in furs, which the Iroquois exchanged for European fabrics, but more especially

for firearms, in the use of which they afterwards became so expert. The English, in turn, cultivated the same relations of friendship which had been commenced with them by the Dutch. A "covenant chain" was established between them, which the Iroquois, with singular fidelity, preserved unbroken, until the independence of the American States terminated the jurisdiction of the British over the country.

It was otherwise, however, with the French. From the first to the last they encountered the uncompromising and inveterate enmity of the League.

As early as 1609, Champlain, having ascended through the lake which now bears his name into Lake George, accompanied by the Adirondacks, fell in with a party of the Mohawks numbering about two hundred, and an engagement ensued between them on the western shore of the lake. This was the first battle between the Iroquois and the Europeans, and the first time the former heard the sound of firearms, by the marvellous power of which they were then easily vanquished.

The French having allied themselves with the Adirondacks and Hurons, given them arms and assistance, and incited them against the Iroquois, a spirit of hatred was aroused against them, which never ceased to burn until the final subjugation of Canada by the British in 1760.

Besides their alliance with their ancient enemies, the French were more inclined to resort to intimidation in their intercourse with the Iroquois than to conciliation and forbearance. In addition to these errors of policy, was the deep and abiding interest taken by the latter in the country about Montreal, which in ancient times had been the home of their fathers, which had been the theatre of their first military success, and which they had long continued to hold by the slender tenure of Indian conquest. As the rival colonies of France and Great Britain were for many years nearly equally balanced, the enmity and power of the Hodenosaunee (which name the Iroquois took after the formation of the League, and which signifies "the people of the long house") were sufficient to turn the scale against the former.

With the possession commenced not only the rapid elevation, but absolute supremacy, of the Iroquois over other Indian nations.

In 1643 they expelled the Neuter nation from the Niagara pen-

insula, and established a permanent settlement at the mouth of that river.

They nearly exterminated, in 1653, the Eries, who occupied the south side of Lake Erie, and from there east to the Genesee, and thus possessed themselves of the whole area of Western New York, and the northern part of Ohio.

About the year 1670, after they had finally completed the dispersion and subjection of the Adirondacks and Hurons, they acquired possession of the whole country between lakes Huron, Erie, and Ontario, and of the north bank of the St. Lawrence to the mouth of the Ottawa river, near Montreal. On the north shore of Lake Ontario they founded several villages, in the nature of colonial towns, to maintain possession of the conquered territory.

They also made constant inroads upon the New England Indians, who, after their partial subjection by the British, were unable to cope with the formidable Iroquois. About the year 1670 they compelled them to break up many of their settlements, and flee for safety and protection to the borders of the British plantations. The name of the Iroquois had then become a terror among Indian nations. "I have been told" (says Colden) "by old men in New England, who remember the time when the Mohawks made war on their Indians, that as soon as a single Mohawk was discovered in their country their Indians raised a cry from hill to hill, a Mohawk! a Mohawk! upon which they fled like sheep before wolves, without attempting to make the least resistance."

In 1680, the Senecas, with six hundred warriors, invaded the country of the Illinois, upon the borders of the Mississippi, while La Salle was among the latter, preparing to descend that river to the sea.

So great was the dread and consternation of the Illinois that they were inclined to abandon their villages and retire from the country to escape the fury of the conquering foe. At various times, both before and after this period, the Iroquois turned their warfare against the Cherokees upon the Tennessee, and the Catawbas in South Carolina, frequently returning from their distant expeditions with numerous captives to grace the narrative of their invasions.

All the intermediate country between the Alleghany and the Tennessee acknowledged their authority, and the latter river became their southern boundary. War parties of the League also made irruptions into the country of the Miamis, others penetrated into the

peninsula of Michigan, and still others were seen upon the distant shore of Lake Superior. The fame of their achievements resounded over the continent.

On the south-east, also, they extended their conquests. As early as 1507, Captain John Smith, the founder of Virginia, encountered a band of the Iroquois, in several canoes, upon the upper part of the Chesapeak bay, then on their way to the territories of the Powhattan confederacy. The Shawnees, Susquehannocks, Nanticokes, Unamis, Delawares and Minsi, were vanquished one after another and reduced to the condition of dependent nations.

Even the Canarse Indians, in their sea girt home upon Long Island, found no protection against their attacks. In fact, they traversed the whole country from the St. Lawrence to the Tennessee, and from the Atlantic to the Mississippi.

For about a century, from the year 1600 to the year 1700, the Iroquois were involved in an almost uninterrupted warfare. At the close of this period, they had subdued and held in nominal subjection all the principal Indian nations occupying the territories which are now embraced in the States of New York, Delaware, Maryland, New Jersey, Pennsylvania, the northern and western parts of Virginia, Ohio, Kentucky, Northern Tennessee, Illinois, Indiana, Michigan, a portion of the New England states, and the principal part of Ontario. Over these nations the haughty and imperious Iroquois exercised a constant supervision. If any of them became involved in domestic difficulties, a delegation of chiefs went among them and restored tranquility, prescribing at the same time their future conduct. Some of these nations, like the Delawares, they prohibited from going out to war, having denationalized them by taking from them all civil powers. According to the Indian notion they were made women, and were henceforth to confine themselves to pursuits appropriate to the Indian female. Such was the general awe and fear inspired by their warlike achievements, that they dictated to Indian nations their own terms of intercourse, and insisted upon the fulfilment of their requirements.

About the year 1700 the Iroquois reached their culminating point. They had reared a colossal Indian empire, so far as its sway over the aborigines was concerned, and in comparison with any Indian power which had risen north of the Aztec monarchy.

From about the year 1640 to the year 1700 a constant warfare

was maintained between the Iroquois and the French, interrupted occasionally by negotiations and brief intervals of peace. As the former possessed both banks of the St. Lawrence, and the circuits of lakes Erie and Ontario, they intercepted the fur trade, which the French were anxious to maintain with the western nations. Upon this trade much of the prosperity of the new colony depended, for it furnished the chief article of export, and yielded the most profitable returns. But the war parties of the League ranged through these territories so constantly that it was impossible for the French to pass in safety through the lakes, or even up the St. Lawrence above Montreal. Their traders ware captured and led into captivity or to the stake, and the rich furs became the spoil of the victors.

So great was the fear of these sudden attacks that both the traders and the missionaries were obliged to ascend the Ottawa river and then cross over to the Sault Ste Marie, and the shores of Lake Superior.

For these reasons the French were extremely anxious, either to detach the Iroquois from the British and gain their alliance, or to reduce them to subjection by conquest. They tried each successively, and in both were equally defeated. The untractible and politic Iroquois were averse to the former, and too powerful for the latter.

On numerous occasions the ambassadors of the League were at Montreal and Quebec to negotiate for the adjustment of difficulties and the exchange of prisoners, in some of which negotiations the terms of a peace, or at least of an armistice, were agreed upon; but these respites from warfare were of short duration. The ravages committed upon the settlements of the French were so frequent and so devastating as to place the colony in imminent peril. But for the constant supplies from the mother country the French power in Canada would inevitably have been overthrown at different periods prior to 1700.

To retaliate for these frequent inroads and to prevent their recurrence, the country of the Iroquois was often invaded by the French. In 1665, M. Courcelles, governor of Canada, led a strong party into the country of the Mohawks, but the hardships they encountered rendered it necessary for them to return without accomplishing their purpose.

The next year, M. de Tracy, viceroy of New France, with 1200

French and 600 Indians renewed the invasion with better success. He captured Te-a-ton-ta-lo-ga, one of the principal villages of the Mohawks situated at the mouth of the Scholarie creek. Again, in 1684, M. De La Barre, then governor of Canada, entered the country of the Onondagas with about 1800 men. Having reached Hungry bay, a conference was held with a delegation of Iroquois chiefs, headed by Garangula, the celebrated Onondaga orator. After they had exchanged recriminations and mutual defiance, a species of armistice was finally agreed upon, and thus the expedition ended. In 1687, M. De Nouville, with 2000 French and 600 Indians, landed at the head of Irondequoit bay, within a few miles of the principal villages of the Senecas. After repulsing a body of 500 Senecas, he destroyed their cornfields and villages. He then took formal possession of the country in the name of France, after which the French army retired.

To retaliate for this invasion, the Iroquois, in the fall of the same year, attacked Chambly on the Sorel river. Unable to capture the fort, they ravaged the settlements adjacent and carried off a number of captives. About the same time a party of 800 attacked Frontenac, on the site of Kingston, and destroyed the establishments of the French outside the fortifications. In July of the ensuing year a band of 1200 warriors made a descent upon the island of Montreal. The first intimation the French had of impending danger was the fearful onset of the Iroquois. All who were without the fortifications were slain or taken prisoners. Their houses were burned and the whole island covered with desolation. About a thousand of the French, according to some writers, perished in this invasion or were carried into captivity. Overwhelmed by this sudden disaster, the French destroyed their forts at Niagara and Frontenac, and thus yielded the whole country west of Montreal to the possession of the Iroquois. In the winter of 1692, Count Frontenac sent a detachment of 600 French and Indians against the Mohawks. They surprised and captured three villages, took three hundred prisoners, and returned with the loss of thirty men. Again, in 1696, Count Frontenac conducted an expedition in person against the Onondagas and Oneidas with a thousand French and as many Indians. He landed at the mouth of the Oswego river. From thence he marched to the salt springs, near the site of Syracuse, and up the Onondaga valley to the principal village of the Onon-

dagas. He found it, as usual, deserted, although fortified with palisades and supplied with stores of corn. The village was then burned, and the growing corn, which was found in great abundance in the fields adjacent, was cut down with the sabre. A detachment was then sent against the Oneidas under M. De Vaudreuil, by whom their fields were laid waste, after which the French army returned to Canada. This was the last French invasion of the territories of the Iroquois. A general peace soon followed, and continued without interruption until the war of 1755.

From the commencement of English intercourse with the Iroquois, down to the independence of the American States, the covenant of friendship between them remained unbroken. The importance of conciliating this powerful confederacy was fully appreciated by the colonial authorities. Unwearied pains were taken by them to secure and retain their favor and confidence. Each successive governor announced his arrival to the Sachems of the League, and invited them to meet him in council at an early day to renew the "covenant chain." Each new alliance was cemented by presents and mutual professions of kindness. An intercourse sprang up between them in matters of trade, and in public affairs, which continued to increase until councils with the Iroquois became nearly as frequent as the sessions of the provincial legislature.

The Tuscaroras, upon their expulsion from North Carolina, in 1712, turned to the north, and sought the protection of the Ho-de-no-sau-nee, on the ground of common origin. That they were originally descended from the same stock is sufficiently evinced by their language. They were admitted into the League as the sixth nation, and were ever afterwards regarded as a constituent member of the confederacy, although never admitted to a full equality. After this event the Iroquois were known under the name of the "Six Nations."

A portion of the Oneida territory was assigned to them, lying upon the Unadilla river on the east and the Chenango on the west. The Oneidas, as the original owners of this tract, were made a party, with the Tuscaroras, to the treaty of Fort Herkimer, in 1785, by which it was ceded to the State. The Tuscaroras were partially scattered among the other nations, although they continued to preserve their nationality. At a subsequent period, the Senecas gave them a tract of land on the Niagara river, where they afterwards

removed, and their descendents still occupy a reserved portion of this land near Lewiston.

It is difficult to form a correct estimate of the number of the Iroquois. La Hontan placed them at 70,000. The estimate made by Col. Coursey, at Albany, in 1677, gave them about 15,000. Bancroft estimates them, including the Tuscaroras, at 17,000. Sir William Johnson, in 1763, estimates them at about 10,000. In 1750, from various causes, they had become diminished about one half. A prominent cause of the decline of the Iroquois was the large number induced, at various times, to emigrate to the banks of the St. Lawrence under the influence of the Jesuit missionaries, and who, by placing themselves under French protection, became the enemies of their kindred and of the League.

The most successful colony of this description was that established by the Abbe Piequet on the site of Ogdensburg in 1749. The first year he constructed a fort of palisades and commenced with six Iroquois families; in the second year the number of families had increased to eighty-seven, and in the third to 396. Such was the influx from the territories of the League to the new missionary establishment that, in 1754, the number of inhabitants in their three villages, at and near the site of Ogdensburg, was estimated by the French at 3,000. This band was afterwards known as the "Praying Indians," from their conversion to Christianity.

The period of their greatest prosperity, and of their highest numbers, was evidently about the year 1650. At that time, their total population may safely be placed at 25,000. A higher estimate would be better supported by such data as the case affords than a lesser one, although the impression of later writers seems to be to the contrary.

From the close of the French war until the commencement of the American Revolution was a time of general peace. The Revolution placed the Six Nations in a position of great difficulty, as the Continental congress negotiated to secure their neutrality and the British their assistance. Their sympathies were strongly enlisted in favor of their ancient ally, with whom, for upwards of a century, they had maintained an unbroken friendship. They were thoroughly British in sentiment.

When the question of declaring for the British came before the council of sachems and chiefs, the Oneidas alone resisted the meas-

ure as unwise and inexpedient. Their opposition defeated the war measure as an act of the League. All the sachems of the League, of whom there were fifty, and in whom originally was vested the entire civil power, were required to be of "one mind" to give efficacy to their legislation. Unanimity was a fundimental law. The idea of majorities and minorities was unknown to the Iroquois.

The number of sachems was so unchangeable that upon the admission of the Tuscaroras as the sixth nation of the League, the council of sachems was unwilling to increase the number and the Tuscaroras never had a sachem who was admitted to all the privileges of a sachem of the Confederacy. The celebrated Joseph Brant was but a chief—the office of sachem being surrounded by impassable barriers against those who were without the immediate family of the sachem and tribe in which the title was hereditary.

At the close of the American Revolution, although the Oneidas had remained neutral, they fared little, if any, better than the other five nations.

TELEGRAPHIC COMMUNICATION WITH A MOVING TRAIN.

BY GEORGE BLACK, ESQ., OF THE G. N. W. TELEGRAPH CO.

This subject has attracted considerable attention lately, arising from the announcement that Edison, the wizard of Menlo Park, had solved this somewhat wonderful problem. This is not a new achievement, though accomplished by new methods. I purpose to briefly review the different methods in order, and in doing so will have to refer to the writer's own efforts in this direction.

Keeping up communication with a moving train is accomplished in two ways,—first, by the train running in contact with an electric conductor; and, secondly, by *inductive* influence from conductors near the train.

The first method is the oldest. The earliest record that I have refers to a couple of patents issued in England nearly thirty years ago. The next was the joint production of Mr. Givin, of this city, and myself, in 1874. We experimented and improved our original idea, filed a caveat in Canada, and applied for an American patent in 1876. Naturally thinking we were the pioneers in this department, we claimed the complete device as broadly as possible, but were confronted with the English patents referred to. A visit to Washington, in November, 1876, enabled me to examine copies of these patents and so modify our claims as not to conflict. Fortunately the patents had expired, so that we could use what we could not claim. The examiner, however, was absent from duty, and his assistant did not wish to act in his absence, so that the changes could not then be made, and time elapsing, the patent was declared abandoned through no fault of ours.

The device was exhibited to W. K. Muir, Esq., then General Manager of the Canada Southern Railway Co., at St. Thomas, who was greatly interested in the arrangement, and offered facilities for an actual test on that road. The principal idea was to suspend a

wire close to the railway track, in such a manner that a projecting arm extending above and out from the side of a locomotive or car carrying a flanged roller would make metallic contact with the suspended wire, thence through the signalling instrument and battery to the running gear of the locomotive or car, thus completing its circuit through the rails. The wire was "open" or "insulated" at the ends of each blocked section, so that a train running in contact with this wire would receive a signal if another train intruded upon its blocked section, or if the station at either end closed the circuit. The signals would then go off automatically, meaning "danger;" both trains would receive the signal, and by a prearranged code could arrange what each should do. Open switches or drawbridges signalled "danger" to all approaching trains. Trackmen could also signal danger by simply attaching a wire to the rail and throwing the other end over the signal wire. No operator was required, as only simple danger and caution signals need be used, which the engine drivers could easily manage. In working out the details various obstacles presented themselves, but were overcome. One was the probability of trains using batteries with similar poles to the line. In such an event, two trains might collide without a warning through depending upon this signal. Again, batteries might be too weak to operate the signals at the critical moment, though apparently in good order. We succeeded in devising instruments that would respond, regardless of the polarity of batteries, and which indicated if batteries were defective.

About this time, Sir David Salomons, of England, patented his arrangement, which was arranged for a double-track road, with trains running only in one direction on each line of rail. He employed a third light rail between the other two, and a wire brush under the locomotive kept instruments in contract with the extra rail, completing his circuit through the outer rails. A clockwork mechanism sent a current to line for a certain number of seconds, then placed the instruments in position to receive a signal for the same length of time. This was a more expensive arrangement than the one just described, and, in our opinion, not so well adapted for the purpose. Several other similar devices were subsequently patented, but nothing of real merit has come to my notice.

With the advent of the telephone and transmitter, and especially the magneto signal, it occurred to us that our signal could be modi-

fied to use a telephone instead of a telegraph instrument, and thus enable trainmen and railway officials to speak while in motion. The signal would go off in the usual manner, and then verbal arrangements could be made. This identical arrangement was patented about two years ago by a couple of men connected with the Michigan Central Railway. Our arrangements were as fully adopted as if they had been supplied with our drawings and specifications. This is not surprising, as several parties connected with the C. S. railway were fully aware of the mechanical details, and the telephone added got over all the electrical difficulties; but it is not remarkable for several inventors to bring out the same device simultaneously, or reinvent what has already been brought out. A certain want is felt; several parties endeavor to supply the want, and at last two produce the same contrivance.

For perfect protection of trains from collision, I cannot imagine a better arrangement. A block section of rail of one or two miles, according to the traffic, absolutely secured for a train. Should a second train trespass upon this section, from any cause whatever, both trains would receive a danger signal. A train started in error could be arrested and brought back. We also used a device whereby a person at a station could *feel* if the section was clear without signalling the train.

THE INDUCTION METHODS.

We now turn to the second method of signalling, namely by "induction." It is difficult to describe induction briefly, but it may be understood by the attraction a magnet has for iron or steel in proximity to it. The magnet *induces* magnetism in the iron or steel, and if they are free to move they will be attracted towards each other. A wire with an electric current flowing through it, *induces* an electric current in another wire in its vicinity.

You are all familiar with the foreign sounds heard in telephones. These are chiefly caused by induction. A telegraph operator listening at a telephone, can easily read dispatches transmitted over neighboring wires. Taking advantage of these principles, Lucius S. Phelps, of New York, perfected his system and made it public early in 1885. He fitted up twelve miles of the New York and New Haven railroad, between Harlem River and New Rochelle Junction, and its operation was pronounced to be all that Phelps claimed for

it, telegrams passing to and from the moving train as rapidly as between fixed stations. The system may be briefly described as follows:—A copper wire is enclosed in a grooved board or trench between the rails; this wire forms the conductor, and is attached to the instruments at the depots. A coil of wires enclosed in a tube passes up over a car and down underneath, immediately over the wire between the rails and about seven inches from it. This coil is attached to the instruments and battery in the car, in a similar manner to that at the station. The act of transmitting actuates a vibrator or "buzzer," which induces a rapid humming sound in the receiving instrument, at the stations, a telephone, and in the train, a specially devised telegraph receiver. This receiver though delicate enough to receive the hum of the vibrator through an air space, is not influenced by the motion of the train. This instrument works a telegraph sounder in the usual manner. Phelps has also adopted an overhead wire instead of that between the rails, and has secured it as a telephone signal for speaking instead of telegraphing.

EDISON'S SYSTEM.

We now come to Edison's system, called by some the "air telegraph." It, like that just described, depends upon the influence one conductor has upon another.

Mr. Wm. Wiley Smith, of Tennessee, observing the influence a telegraph wire had upon a telephone wire, secured a patent which forms the basis of this system. Mr. E. T. Gilliland and Mr. Edison afterwards took hold of it and brought the system to its present state of perfection. The instruments consist of an induction coil, with a vibrator or buzzer actuated by four or five cells of battery, a Morse transmitting key, and a pair of receiving telephones, made light and fitted upon the operator's ears, so as to exclude all external sounds and enable him to hear to the best advantage. One leading wire is attached to the the metalic roof of the car, and several car roofs are connected together, presenting a large metallic surface to the inductive influence of the telegraph wires. The other wire connects with the rails through the wheels and axles of the car. The station instruments are similar to those in the car, but are attached to three or more telegraph wires by means of *condensers*, and also with the earth or rail to complete the circuit. The space between the wires and the train is *jumped* over by the signals in some manner, so that

a signal sent along the wires influences the receiving instruments on the train and vice versa. This system has also been subjected to very severe practical tests, and its operation pronounced most satisfactory.

By employing condensers, Edison makes use of the ordinary telegraph wires, which carry their usual traffic while his induction signals are passing over the same wires. By using several wires he presents a larger metallic surface to the inductive influence of the train, and thereby secures greater success. He noticed that while the ordinary Morse signals could be heard through a certain distance in a neighboring wire, that very rapid signals or vibrations could be heard still further, so that the buzz of the induction coil passes through the air quite a distance between the conducting wires and and the railway train, the comparatively slower Morse signals failing to reach that distance. He claims that these rapid pulsations actually are conducted through the air—that air, though an insulator for ordinary electric signals, is a conductor for signals of very short duration. Others contend that the action of the condenser or Leyden jar is a sufficient explanation—namely, an inductive influence passing between two metallic surfaces from a charged to an uncharged surface, with an insulating substance (or air space) between, which may be a sheet of mica or paraffined paper in the case of the condenser, or an air space, or Edison's train.

The difference between the Phelps and Edison systems is slight, the former costing more to install; Edison using the wires already in use, while Phelps requires a special wire. Both use telephone receivers and buzzers controlled by Morse keys as transmitters. Phelps' system was publicly tested a year before Edison's, but Smith's patent may antedate Phelps'.

I pointed out the use of condensers in 1878 for the purpose of simultaneously telephoning over telegraph wires, and also for bridging around telegraph instruments to preserve an unbroken path for this purpose, as Edison now uses them; but Varley, of England, used the condenser for telegraph purposes at a still earlier date. The buzz telegraph, also, was in use between Toronto and Hamilton in 1877 and 1878, by Dr. Rosebrugh, of Toronto. The use of the rails and running gear of the train to complete the circuit was known and used at a much earlier date, so that the only original part in these two systems is in observing and taking advantage of the

great distance over which induced signals could be transmitted. Mr. W. L. Silvey, of Cincinnati, claims to have worked and patented this idea in 1883, having telegraphed between wires 200 feet apart.

As to the value of these systems, the first described, keeping in contact with a wire simply for train protection, is the best for railway purposes. It does not require an operator on each train, and each train is automatically signalled if there is danger. The Phelps and Edison systems are, no doubt, the best for commercial purposes, enabling passengers to send and receive their telegrams while *en route* as easily as at home.

THE PUBLIC TREATMENT OF CRIME AND CRIMINALS.

BY WILLIAM MILNE, ESQ.

(*A Paper read before the Hamilton Association, 7th April, 1887.*)

"A general definition is that crime, in its legal, as opposed to its moral or ethical sense, is an act done in violation of those duties for the breach of which the law has provided that the offender, in addition to repairing, if it be possible, the injury done to the individual, shall make satisfaction to the community. A private wrong, or civil injury, on the other hand, is an infringement on the rights of an individual merely, for which compensation to him is held, in law, to be a complete atonement." (Steven's Com IV, P. 77.)

From this definition, which is that generally adopted by lawyers, it is obvious that legal criminality is not a permanent characteristic attaching to an action, but one fixed upon it arbitrarily, from considerations of expediency. Without changing its moral character, the same action may be, and very often is, a crime in one country or in one generation, and no crime in another country or a succeeding generation. Malice or evil intention, however, is in all cases, essential to the character of crime, for though there may be an immoral act which it is inexpedient to punish as a crime, it never can be expedient to punish as a crime what is not an immoral act.

Anterior to all regulations for the punishment or suppression of wrongs by an exercise of public authority, there was, as is generally agreed, a time when injuries found redress only through the resentment and retaliation of the injured party or his kin. The progress of society from this rude sort of vindicative justice, toward approved systems of criminal law, presents some suggestive examples of the devious paths through which communities were led to the recognition of truths which appear to us elementary.

In order to secure an accurate conception of the early growth of the legal system, it may be well to premise that the criminal law, which, with a substantial uniformity of cardinal ideas, now prevails

in all civilized states, is well defined as "that branch of juridical law treating of those wrongs which the government notices as injurious to the public, and punishes by what is called a criminal proceeding in its own name."

If it is desired to ascertain the point at which public authority began to supercede private revenge in the punishment of wrong-doers, it is worthy of observation that instances abound of tribes among whom the only offences punishable by public authority are treason and its cognates, such as cowardice and desertion. Indeed, we can scarcely imagine a phase of society but treason, if committed, would be so punished.

The institution of government for military purposes involved the immediate rise of those branches of criminal jurisprudence which have for their objects respectively, to preserve the government and to secure the efficient discharge of its military functions. It may be said with perfect accuracy, that every criminal law has for its object either to preserve the existence of government or to secure the adequate discharge of its functions. Many acts, involving no moral delinquency, are declared crimes, others, of an immoral nature, are not. There are many of the American Indian tribes among whom the exercise of public authority for the protection of person or property is unknown, who yet, in times of war, organize a temporary government by the election of a military chieftain, whose powers, within their limited sphere, are absolute, and are rigorously exercised in the punishment of cowardice, desertion and military insubordination. This is the extent of their criminal law. It is, therefore, in this class of offences that criminal law must have had an early but meager origin under the military confederations to which the most primitive societies intuitively resort. It might be supposed that communities thus familiarized with the punishment of crime by public authority would rapidly develop a criminal jurisprudence, by the simple and direct process of adding, from time to time, new crimes to their catalogue of offences. But it will be observed that in none of these cases does the concerted action against the offenders proceed upon the notion that it is the function of government to protect its citizens against crimes. It is induced in each case simply by a widely prevailing feeling of personal resentment or fear. The tardy growth of criminal law is to be ascribed to their ignorance of what the functions of government were.

The sporadic and personally revengeful punishments throw little if any light on the development of the law of crimes.

The most important, interesting and difficult in the history of criminal jurisprudence, by which society abandoned its original assumption that acts of violence or fraud between individuals are purely private grievances to be redressed by private remedies, and charged government with the function of protecting its citizens from such wrongs, through proceedings conducted and punishment administered in its own name.

The secret of that movement and the influence by which its progress was shaped can be gathered only from study of the antecedent practice of private retaliation. For both by its weakness and its strength the system exercised a controlling influence over the development of the new. It was at once the chief inducement to the change and the chief obstacle to its accomplishment. In so far as public authority assumes by penal remedies to protect individuals from the criminal acts of one another, it was first called into existence, not by ordinary wrong-doing, but by an effort to restrain the abuses and excesses of retaliation as a remedial system. Its subseqent extension, so as to displace the avenger and assume the punishment of wrong-doers generally, was an after thought. Thus the movement had its origin in a desire rather to mitigate the punishments than to insure or increase them. The tenacity with which the avenger adhered to his right of redress, and the difficulty of controling him in the exercise of this right, are further attested by the character of the expedients by which it was sought to fortify measures aiming at his restraint.

When, by the demoralizing prevalence of feuds, society was first awakened to the necessity for taking measures to investigate or suppress them, it is undoubtedly true that even if there had been a general willingness to abandon private revenge in favor of public prosecutions, the men of that period were incapable of either conceiving or executing so comprehensive a remedial scheme.

Thus Moses, though the Israelites were, in his day, quite familiar with the public prosecution of crimes, some of which were entirely withdrawn from the domain of private retaliation, found it still necessary to recognize the blood-avenger's right personally to pursue and slay without form of law the willful murderer: "the avenger of blood shall slay the murderer; when he meeteth him he shall slay him."

But, as under the most primitive codes of honor, so among the early Israelites the principle of blood avengement was so malignant as to require retaliation even against the involuntary man-slayer. The instrument of death, whither man or beast, the avenger was in honor equally bound to destroy, without reference to the malicious or accidental character of the homicidal act.

The flagrant injustice of punishing with death the involuntary acts void of moral guilt, was in the Mosaic age probably as manifest to a large number of the Israelites as to Moses himself; yet so deeply rooted was the practice in the traditions of the people, that the great law-giver dismissed as impractable the idea of abolishing it. His scheme for ameliorating the hardships of both the willful murderer and the involuntary homicide by the designation of cities of refuge within the limits or vicinity of which they could find protection from the avenger, the former until he should have opportunity to prove his innocence, and the latter until the occurrence of some event with which his final discharge from liability could be plausibly linked, bears witness upon its face to the difficulty he anticipated in its enforcement.

That his plan might be fortified by religious reverence and sacred associations, he provided for the selection of the cities of refuge from among the cities of the Levites, and dated the freedom of the excusable homicide from the death of the high priest. "The law essayed its earliest exercises in reconcilement." At a time when murder was merely a private wrong, of which government took no cognizance, and the right of retaliation was thought too sacred for government to deny, the public interested itself only by discouraging revenge through the agency of public opinion, and by inviting and recommending pecuniary compositions with wrong-doers at rates which were usually fixed by law or custom, without, however, assuming to coerce either party to a settlement. Later, the law, in order to avert feuds, declared it a crime to refuse to offer or accept pecuniary compensation. Government, while it had not yet undertaken to prevent or punish ordinary murders or larcenies, had been driven to apply itself to the suppression of feuds; and the withholding or rejecting of composition money, tending to defeat its efficient discharge of that function, had the properties of a true crime, and was promptly recognized and punished as such.

Sir Henry Main traces the widely discrepant penalties under

consideration to a tendency, on the part of early administration of justice, to "similate" the probable acts of persons engaged in a private quarrel. "It is curious to observe," he says, "how completely the men of primitive times were persuaded that the impulses of the injured persons were the proper measure of the vengeance he was entitled to exact, and how literally they imitated the probable rise and fall of his passions in fixing the scale of punishment."

While King Alfred, anticipating the age in which he lived, and probably inspired by the example of Moses, denounced against wilful murders the punishment of death, his law was a dead letter, and remained unexecuted during his own reign and those of several of his successors. Then people preferred to redress their own grievances.

Mohamed, in the Koran, adheres to the law of personal retaliation for bloodshed. He councils forgiveness or compositions on the part of the aggrieved persons.

The process of enforcing these and other limitations upon parties at feud, resulted in developing and illustrating the idea of regulating by criminal laws the conduct of citizens toward one another, and thereby paved the way for the subsequent more general application of the same principles.

There was another class of measures which tended to the same end, by serving especially to mature a judicial machinery, and to familiarize the people with its operation. Next to its total abolition, the most effective remedy for evils of blood-avengements was to forbid its exercise until the accused person should have had an opportunity to submit the question of his guilt to investigation in court. For the time employed in the trial, and the protection afforded by it, a reasonable compensation, called "Freedom" by the Germans, was usually paid by the accused to the judge or king.

It is not difficult to understand how impositions of this sort, exacted at first for time consumed and protection afforded by the state for the accused, might readily adopt themselves to, and even assist in the development of criminal law, by gradually assuming the character of fines for the offences charged. Another line of progress of importance in some societies, consisted in a gradual enlargement of the classes of offences in which the king or state was supposed to have such an immediate interest as to justify a claim to a part of the composition money. Thus an injury to the person or property of

any of the king's household, retainers, officers, or agents, was early construed to be an injury to himself. So, likewise, with wrongs committed against a guest of the king, or persons of a household by whom he was entertained; or violence committed in the immediate presence, or in his castle, and afterward in the city or province where he was residing, or under other circumstances, which, within the slowly expanding ideas of the subject, could be construed as involving an offence against the king's person and dignity. It is an observation of an historical writer, that in every branch of knowledge, example has preceded precept. So it was in the early history of criminal law. To a very great extent, it was practised before the theory was conceived, or its first principles formulated. It was only after its judicial machinery had been developed by such random or diverse considerations, and for such special purposes as those heretofore enumerated.

We have a system of penal laws for the protection of individual rights and the conservation of society by punishing prescribed offences; and the general notion is, that this system is coeval with government, and was originally instituted essentially in the present form and for its present purpose. This, however, is a great mistake. Government arose in tribal antagonisms, was a militant organization against external foes, and recognized no crimes except such as treason, cowardice, desertion, or such acts as injured itself. There was at first not the slightest idea of protecting citizens against crime by punishing private offences. Government had no internal police or judicial processes, and the rule of punishment was that of private personal vengeance. Society, as a consequence, was torn by internal feuds and bloody violence, and was ruled by the spirit of retaliation and revenge. We have had a glimpse of the extent and atrocity and tenacity of this system, and how criminal laws arose out of the necessity of regulating the excesses of malignant blood-avengement.

The criminal history of society has a grave significance as interpreting the spirit by which crime is still treated. For, although government has abolished retaliation, and itself assumes the prerogative of punishing crime, it has not outgrown the vindictive passions of the barbarous past. In the prison treatment of criminals we still see survivals of the old savage feeling of vengeance that has not yet died out of the community. By the abolition of torture we have conceded that criminals have rights, but no conception of the cor-

relative right of the criminal and of society is allowed to determine the kind and degree of punishment.

What but the spirit of vengeance is it in society which prevents the convict from having all the sympathy of treatment and chance of self-help and amendment that are consistent with his detention in prison as a measure of public security.

In the course of social progress the vengeful feelings have been more and more constrained by the growth of humane sentiments, and their modes of exercise have been transformed, but there is plenty of room for further salutary change.

If the general notion of society was mistaken as to the origin and development of criminal law, there is still much misconception of its operation in our own time. I think it will be conceded that many hold an opinion that the administration of our criminal law is as nearly perfect as now practised as we can make it. The general understanding being that punishment represses crime; that it also affords considerable protection against wrong-doers, and to some extent reforms the criminal. The fear of punishment may to some extent deter those who never have been convicted, but the dread of punishment does not deter the criminal; this is clearly seen on looking at the number of recommitals shown by statistics. The only protection I know of is, while the criminals are confined within prison walls they are then prevented from preying upon society. We may feel certain when set at liberty they will follow their former vocation. This is not a mere matter of choice with them; they have no other means of living. It is a mistake to say they can work, for no one will employ them; we have branded the mark "*Felon*" upon them; society is therefore afraid of them; decent people will not associate with them nor allow them into their houses; they are looked upon as outcasts; they are in many ways made to feel they are such; force of circumstances compel them to return to their former haunts and modes of life.

We need not be surprised to find that our system does not reform; it was not intended nor adopted to that end. That it does not reform, I may be allowed to refer to penitentiary and prison reports. In doing so, I do not intend to present this subject in its statistical phase, but only to refer to certain items (only having the report for the year 1874 for Ontario by me, I shall use it). On page 69 we find there was committed to our common gaols, for the first

time 6348, for the second time 1371, for the third time and oftener 1192; the total number committed for that year was 9488; but to this number should be added 58 committed to the reformatory at Penetanguishene.

The avowed object of this institution now, is for reclaiming boys and young lads who are either orphans or children of dissipated, good-for-nothing parents. When, for some petty offence, a number of those are sent to this institution, for periods varying from two to five years, no doubt, the intention being to provide them with a comfortable home, instruct them in some useful trade, and the several branches of a secular education, and to train them to habits of industry and orderly conduct, also to impart sound moral and religious instruction, so that when their several sentences expired they might be returned to society without the "felon's" mark upon them, they being able and willing to work for their living, fitted in every way to become useful and respected members of the community. How well this institution performs the functions of a reformatory may be learned from the report, page 58: "Carrying out the ideas suggested by the act to which it owes its existence, the institution is veritably a prison for young offenders, rather than a reformatory, as at present understood in the chain or system for the reclamation of criminals. The appearance of the building is that of a prison, the interior structure is that of a prison, the discipline is that of a prison, the dress is that of convicts. The elementary principle of reformatory agency is wanting—classification; there are no means to attain that end, and the infant in years and in crime is exposed to the contaminating influence of the youth hardened in iniquity. These matters have been constantly mentioned in my reports, but have not hitherto met the consideration they deserve." In his concluding remarks the inspector says: "Of the means necesary to procure so desirable an end as is indicated in the foregoing paragraphs, little more need be said than that they would require a complete revolution of the present system, and that the Provincial reformatory should become a reformatory in fact, instead of being a prison for young offenders.

"I am satisfied that the excessive increase in the number of prisoners committed to our gaols during the past year is due, first, to a very marked increase in the sale and consumption of intoxicating liquors. Second, to the reception in our midst of a portion of

the criminal and vicious of other countries, attributable to some extent to defective *surveillance* over emigrants arriving in the Province. Third, to depression in trade and the labor market in the United States, which has resulted in the transfer of not a few of their sharpers and criminals to our soil." The report attributes the large increase in the sale and consumption of intoxicating liquors as being the chief cause of the increased number of commitments.

That intemperance is a great evil none will deny, but I am not aware that drunkenness is a greater evil than gluttony. I dissent from the belief, that intemperance, either in meats or drinks, is the chief cause of crime. Although prohibition is claimed by many as the only remedy for this evil, and a number have tried to "boom" it, yet the community does not seem willing to be dragooned into virtue; neither does it always seem clear, the motive is altogether altruistic. Too often the promoters of prohibition lack that "*suaviter in modo*," so necessary in the advocacy for measures of social reform, and they exhibit such "*fortiter in re*" when inforcing their measures where they have power, that repels the masses from accepting the measure with that degree of unanimity requisite to insure beneficent administration. It is commonly supposed that, because nearly all criminals are drunkards, therefore drunkenness is the chief cause of crime. This is a confusion of cause with effect. Crime and drunkenness go together because they are concurrent effects of the same organization. Alcoholic stimulation merely removes prudence and brings out true character without restraint or disguise. The brute who beats his wife when drunk would do so when sober if he dared or could; but what we call the sober state is with him a condition of cowardly depression and feebleness due to the reaction of intoxication. If a number of quarrelsome men assemble and drink together they finish with fighting. If a similar number of kindly disposed men drink together they overflow with generosity, profuse friendliness, and finally become absurdly affectionate. The citizen who would have subscribed a dollar to a charity before dinner will give his name for five after the "toast of the evening."

Temperance agitators fill our ears continually with wails as to how the "demon alcohol is yearly dragging down to dishonorable graves hundreds of thousands of the brightest and fairest of our land." This is supreme nonsense. With few exceptions every one who goes to perdition by the alcohol route would reach that destina-

tion by some other highway, if the alcohol line were not running. Prohibition and criminal reclamation should go hand in hand.

Crime is often imitated; it is also transmitted. Are we not constrained to accept the evidence adduced by such men as De Candolle, Ribot and Francis Galton? Must we not acknowledge that hereditary crime is an important factor, and ought to be taken cognizance of? But the mode of administering our criminal law imposes no restraint on the multiplying of this class. Can there be any doubt that, under our system, they will go on multiplying until an effective reformatory scheme is devised and put into operation?

There is another cause very prolific in propagating crime; that is, contact and association. An advocate of prison reform states that "Vice is more infectious than disease. Many maladies of the body are not communicated by contact, but there is no vice which affects the mind which is not imparted by constant association; and it would be more reasonable to put a man in a pest house to cure a headache, than to confine a young offender in a penitentiary organized on the ordinary plan." Our prison statistics show that prisoners are of all ages, from the mere child to the very aged; many committed for trifling offences, and very inadequate means provided for classification; but mere classification can have little effect in the way of reformation. Our system makes our gaols common schools for crime, and our penitentiary the graduating seminary.

But the question has often recurred to me who the others were? 1st. We have a small number of villainous, irreclaimable knaves, because their grandfathers and their fathers were criminals; they inheriting strong passions, but having feeble powers of resistance follow in the footsteps of their fathers. 2nd. There are numbers who, for the vices and cruelty of unnatural parents, have been compelled to flee from a loveless home to wander uncared for, they know not where. 3rd. If we ask for parents, from many we will be compelled to bear away a heart pained with the oft repeated response, "My parents died before I can remember," or, "when I was a child." Alas! How sure are they to be snared by the wiles of those already schooled in the acts of vice. 4th. Many there are who have received no instruction in morals. None of the "line upon line" process, so needful to habits of confirmed virtue, has been meeted out to them. 5th. Next come the crowds born to, and reared in poverty, who, from natural inability, never succeed in husbanding a

supply to meet the demands of a "rainy day." To such the dark day is sure to come. They can get no work; they must starve, or do the next worse thing, and they do it.

We then apprehend and imprison them as a punishment. Often we do far more, we inflict the severest punishment in our power; for very trifling offences we brand them "*Felons*" and thereby cast them out; we will not then allow them to live *among* us. But they will live *upon* us as parasites.

It is something solemn and touching to stand by the death-bed of a near and dear relative or friend and receive a request to convey the farewell message of love and esteem, or be intrusted with some article as a token of affection to an absent one. But I have been present frequently at scenes which I think were fully as touching. It has been often my duty to take charge of the convicts sent from here to the penitentiary, but before returning I usually had the opportunity of seeing and bidding good-bye to the new convicts, and receiving from many some message that had been forgotten to be said when parting; sometimes articles of clothing to be taken back, or other things as mementoes to friends. These acts clearly showed me they were not destitute of feeling. But before these parting interviews took place they had undergone a "metamorphosis." When last seen they were common prisoners, now they had donned the parti-colored uniforms of the establishment stamped with P. P., also their hair had been cut in the P. P. regulation fashion. Now they were "*Felon Convicts*," and seemed to feel they were doomed to be such for the remainder of their lives. I have seen some of them so overcome with emotion that they could not utter a word until they were allowed to retire and time given to regain their composure. Afflictive as are these facts they are but the beginning of the unfortunate record that constitutes the warp and woof in the lives of these unhappy criminals. That heart that bleeds not with pity at these fearful exposures and trials has never been attuned to pity. What then, it may be asked with the profoundest significance, should be the highest intent, duty or design in the inauguration of a practical system of economic action for the unfortunate criminal? Is not the grand *desideratum*, that which overshadows all else, their reformation, personal, social, and moral? To supplant their vices with virtues. What is their punishment as an end compared with this, save as it facilitates the result sought? Should not every system adopted, every department

created, every officer chosen, every duty imposed, every discipline administered, every instruction imparted, aim, as a final consideration, at the reclamation of the criminal? A late writer on this subject states: "Of all the questions by which modern society can be agitated, there is none more momentous than that of the public treatment of crime and criminals. No man can be found so stupid as to maintain that the present practice is satisfactory, and but few have undertaken to indicate anything that is really much better."

About twenty years ago, and for a period of about ten years, it was my lot to be brought into immediate and daily contact with a considerable number of all classes of criminals. I was thus led to give attention to the administration of justice. I do not assume to have made discoveries of any new facts or anything relating to criminals that has not had publicity before now; but I do think they have not obtained the attention and consideration the subject demands. After taking charge of the gaol here, I soon discovered that nearly all prisoners looked upon society as their enemy, and upon the officers in charge as the chief instrument of their punishment; only a few acknowledged their punishment was deserved, and that their own conduct had brought it upon themselves. Yet, in many cases, their life in gaol was no punishment; it was oftener a haven of rest where they recuperated, being better able to undergo a fresh debauch when liberated. I endeavored to get their opinions or reasons for supposing society, I, or any other officer, entertained feelings of animosity against them. To these questions I never got satisfactory replies. Many would blame the police; others would urge they were drunk when they committed the act, or plead they were compelled to steal or starve. Bye and bye, I began to hope I could do something in the way of reformation, and commenced an evening class for reading, spelling and ciphering, for three evenings every week, for male prisoners that chose to attend. The first evening nearly the whole attended; the second only ten came; the third evening seventeen; the class increased to between twenty and thirty. This was continued over three months; all showed a willingness to learn; I had no trouble in maintaining good order; a few made good progress. I did not attempt to give religious instruction. The sheriff was greatly pleased with the project and the promises of success, but he thought moral and religious subjects should be included. Accordingly, he found a staff of volunteer teachers to take the class

off my hands. A short time after this the secular lessons were dropped, and the two hours were devoted to religious exercises, and in this form the classes were continued as long as I had charge. I thought the teachers were earnest, painstaking people. I know that good impressions were made on a considerable number. I kept track of many of these, but I cannot say that I know of one instance that resulted in reformation. At the commencement, and for nearly three years, I had the belief that a genuine work of reclamation was being done. For many of the most hopeful I obtained employment, and to those that stood in need I gave clothing; to some tools; for others I became surety for board; in most cases I had the same to pay. I found it was a loosing business and gave it up. It became clearly evident to me that under the system thus pursued the only product was a number of whining hypocrites, that would show any amount of contrition, make any promises of reformation, when they thought such would bring them sympathy and aid. I have often heard them boast to one another how effectively they had deceived their teachers. For some time before, and a short time after I took charge, there was no work for the prisoners. The inspector said I must find work for them. The only employment I could get then, was what is known as "shot drill" (a kind of punishment adopted in some military prisons). We had no shot. We took stones, and had the prisoners carry them from one end of the yard to the other for a few hours, and then for a like number of hours carry them back again. This proved to be very satisfactory. True, it was exercise, but of a debasing kind. After a time I found other kinds of work for them; but I soon discovered that a large majority were lazy; many exceedingly awkward and very cunning. They would play all sorts of tricks when they expected to get off without detection. They were kept constantly at work nearly all the time I had charge. I found, with care, they could be made to do good work, and take an interest in it; many had a good capacity for learning; but as they all knew they had only a short time to remain, they would shirk their work when they could. This experiment in teaching and employing them in various kinds of work, conclusively proved to me that a very large per centage of prisoners could, with proper means and methods and care in training, be reclaimed to become useful members of society, and at a very reduced expenditure.

In order to arrive at a knowledge as to how this important work

is to be done, it is pertinent to ask a few questions. But we must first premise that we have entirely abolished punishment (unless for one crime). The words punishment, felon, convict, prisoner, are no more to be heard within these establishments. Errors or even light offences are to be looked upon as mistakes, and remedied by withholding of privileges. Where is this teaching and training to be done? The penitentiaries and some of the common gaols should be altered and modified, or extended in such ways as to adapt them for the purpose without any large expenditure of public funds, as nearly all the work required should be done by the inmates in their regular course or training. The institution should provide a considerable degree of physical comfort and contentment; the diet should be good, substantial and abundant; it should be made attractive, affording every means of enjoying innocent amusements for the hours of recreation, and, in the true sense of the word, made *home-like.* The government should be firm, though kindly, demanding regularity, tidiness, and obedience. Being separated from debasing associations, these influences alone would have great power upon the half-starved, ill-clad, and badly-treated, inducing submission to the more special measures. At the commencement, doubtless, a number will show themselves to be dull or even stupid, careless, ill-mannered and stubborn, and some incorrigible. As soon as incorrigibles are discovered, they should be at once removed to sterner and more restrictive discipline, and kept under restraint until they give ample proof of their willingness to comply with the regulations, and request to be allowed the privilege of the course of training provided. They should also be made aware that any misconduct in general would have the effect of depriving them of privileges, subjecting themselves to severer discipline and detaining them longer in custody. On the contrary, good conduct, persevering attention to their work, diligence in their studies, giving clear evidence of advancing proficiency, will procure privileges and shorten the term of their detention. Every effort and degree of improvement must be promptly recognized and rewarded, with the view to awaken and stimulate a desire for that kind of knowledge and training necessary to the true end of individual life; to impart or arouse a sense of better things that exist, and which are, with many of them, for the first time within their reach. They should be made fully aware that each would be credited with full value of all the work done by them; but against this

credit would stand a debit charged for several items, viz.: For feeding, clothing, lighting, warming, and if, through inattention to instructions or negligence, materials had been wasted, tools, machines, or other property belonging to the institution, damaged otherwise than by common tear and wear, would also be charged against the party in default.

It is an obvious necessity that prisoners will have to earn their living by one kind of labor or another; it has to be considered what course of training will best fit them to become proficient, self-reliant, original and progressive workmen, and must extend sufficiently far to prepare for the one great, common industry of citizenship, recognizing that the power to read, to write and cipher, may be destructive or helpful to good citizenship, according how it is, or is not, guided by an intelligence suffused with conscientious regard for the rights of all men. All classes of citizens ought to have the knowledge which will form a basis for intelligent sympathy and appreciation among different classes of workers, and necessary to their action at the ballot box, in order that each may recognize all as honorable and necessary essential parts of one grand industrial whole. As a means of encouraging diligence and contentment they ought to be afforded the privilege of choosing the special kind of work each had aptitude for, and was naturally inclined to follow as a means of gaining their living. The moral influence of occupation is very great, a sphere of labor, congenial and absorbing, that fully occupies one's thoughts and energies, is a strong safeguard of good conduct. And then it will be necessary to supply them with a knowledge and acquaintance with industrial materials, processes and relations. It should give such a development of physical, intellectual and artistic power as will remove as far as possible the chances of failure, and by giving a just consciousness of strength as will enable them to work always with the hope and expectation of success. The teachers must take the best physiological knowledge the age affords, and under its guidance develop a body capable of enduring all the strains and fatigues likely to be brought upon it by at least the ordinary exigencies of life. They must impart the knowledge which it is their duty to give according to the law of mental assimilation as is discovered and interpreted by the best students of mental growth, to the end that mental dyspepsia may be avoided, and that the best intellectual conditions may exist for the quick and accurate solution of the ordinary

problems of life. They must avoid the mischievous delusion that brain work is in itself, and apart from quality, a nobler or a more respectable thing than hard work. Such education may be a fatal mischief to the workman. They must give such a development of the sense of the beautiful as will enable them, not simply to enjoy the beautiful about them, but such as will give a *finesse* and finish to whatever work they undertake with honesty of purpose and pride in doing what is done well, whether it be the building of a house or the painting of a picture. Every workman should have to the largest possible degree the fine feeling of the artist, while every artist should be recognized as a working man. It should cherish an industrial disposition which leads to cheerful and even happy devotion to some chosen employment, as an avenue through which to make his contribution to the world's wealth. The scheme must recognize the true nature and place of the industrial instinct, that it is the creative instinct; one of the earliest to manifest itself. Why should not the *joy of producing*, which forms so large a part of the child's happiness, be carried forward into the industries of maturer years, deepened and enobled by a knowledge of industrial relations, by experience of the value of industrial products, and above all by the consciousness of duty done in the contribution made to human comfort and well being? Give this instinct a proper development, join with it the best human intelligence and the best human benevolence and you have the ideal man. It is in this case of great importance to recognize, as a fundamental principle underlying the whole, that he who will not work shall not eat; still recognizing that the laborer is worthy of his hire and shall receive it. Over all this a conscience should preside that can say "ought" and "ought not" so loudly and distinctly that its commands can not go unheeded. This work can and should be all done through the ordinary subjects properly related.

There are some who, from some mistaken notions, have made objections to what they call the competition of prison labor with free labor. Are we to suppose this objection is meant to hold good both as regards quantity and quality of work? If admitting quality as a factor it then may demand some little attention. The present system pursued is to let the labor of convicts to contractors. That the products obtained by this system is inferior both as regards materials and workmanship I think there can be little doubt, and in

order to find a market this class of work has to be offered to buyers at a very low figure; the contractors being well aware of this fact, so, in order to make the most of their bargain, they aim to get quantity. I believe very little attention is paid to training the convict to become a good workman; at least I only know of two that mastered their trade sufficiently well so as to be able to get their living by working at it after being released; one at stone-cutting, the other at shoemaking. They served a period of five years each. It is the purchasers of this class of goods that become the unfortunate victims. I confess to have little sympathy for those working-men who show so much timidity in competing with prison labor. It exhibits at once a want of that conscious ability and self-reliance that is a general characteristic of all competent workmen. I think such timidity ought not to receive encouragement by giving it public consideration. Surely there can be none so stupid as to suppose those people are to be kept idle, or that their energies should be wasted in doing something that had no money value. I feel convinced that the community would scout the idea as preposterous of being taxed to keep so many of their number idle, while they were perfectly able and willing to work for their own maintenance. Whatever employment may be chosen good raw materials should be selected, and the best work possible put upon it. It should be a special instruction to those having these matters in charge to carefully avoid underselling, and free labor would have no cause to be alarmed. The grand aim is the reclamation of the criminal. We must not loose sight of the fact that he has many and great difficulties to contend against. He requires and ought to have a large measure of sympathy and encouragement extended to him to help him to overcome them. He has not only to learn something that is new to him, but it is often the case that he has the more difficult task to perform of unlearning both bad habits of life and bad methods of working. It is essential that suitable and constant employment be provided and proportioned to his capacity. It is needless to expect good results if he is to be driven as a beast to his labor. In order that his labor be congenial he ought to have choice; hence the necessity of a considerable range of various kinds of work.

We have now to select that kind of work that will fulfil these conditions, viz.: 1st. It must be a suitable instrument for educating and training the criminal to be a useful, industrious and law-abiding

citizen. 2nd. It must be of that description which is largely required in the community, that when released he may more readily find employment. 3rd. It must have a money value, so that the criminal may, by his own industry, earn sufficient to pay the cost of his maintenance while undergoing training, and to have a surplus to be handed to him when released. 4th. It must not compete injuriously with free labor. Where is this variety of work to be sought for? Looking around, we see that government requires a large amount of work of various kinds that could be as efficiently done in those institutions as by the system of contracts now adopted. 1st. All the clothing, boots and shoes, furniture, utensils, machines and implements of every description required by these establishments, as well as any extensions or repairs for their own buildings. 2nd. There is a large amount of departmental printing, making up account books, book-binding in keeping libraries in repair. 3rd. Then there is clothing, and other necessaries now supplied by the government to the police and volunteers, could be as satisfactorily done in these establishments as anywhere. 4th. The government owns and operates a railway that would afford a considerable amount of work in the building of rolling stock, and in doing all kinds of repairs to the same. So much of the above mentioned works as could be accomplished in these establishments, I believe could be withdrawn from public competition without injury to free labor. But if this plan be deemed inexpedient, there need be no apprehension of injury to free labor if other lines of industry were undertaken, provided the products were always to be of the best quality. It is the inferior products obtained by convict labor that free labor has any reason to complain of.

It must be clearly understood that in order to have reformation of the criminal, or any good work done by them, such can only be accomplished by and through those placed in charge as instructors and teachers. No matter how perfect the organization, or how well devised the regulations may be, the whole may be rendered nugatory by appointing inefficient or incompetent persons to fill so important positions, as good results can arise only through their capabilities for imparting instruction, their skill in management and devotion to duty. Though firm in demanding obedience, they should not be careless in extending sympathy. It must be admitted that persons possessing the needed qualifications are rare, and there may be

difficulty in finding them. I cannot state, as a fact, that they cannot be found. I confess I have no knowledge that they exist. Suppose they are not, this difficulty need not appall us. We have abundant evidence of far greater difficulties being surmounted. Modern society does not seem greatly surprised to hear of the most gigantic schemes projected. The one thing requisite is that these give promise of large profits on investments. If in their way to this end a mountain intervene that cannot be passed over, or it is inconvenient to go round it, then they go through it. So if a continent be in the way, they cut a waterway through it. If it be a river, they bridge it. If we ask how this has come about, we learn that such feats of skill and strength were not attempted, many were not even conceived, until there were a number of men specially trained to deal with that class of difficulties. So in other lines, if special work is to be done, as in medicine, law, teaching, or in handicraft, we have recourse to training. This class may be supplied also by training. It is not necessary to enter into details of management. Very much of the success will depend upon the capabilities of the teachers and instructors in charge. In the first stage of detention, the prisoner should be made feel sensible, from first to last, that it is only through his own exertions, accurately tested by the attainment of a certain number of marks, that he can better his condition. In this manner he works himself into different stages of progress by means of these marks, which simply and intelligibly note and measure his improvement.

I believe the system of liberating conditionally from reformatory institutions is the best safeguard for the good conduct of the party released, and at the same time affording the community the greatest measure of protection against crime. It has been well tested in Britain, Ireland and other countries, and has proved the wisdom of its adoption. This is no new thing. It has been in operation for a considerable time in many States, with various degrees of severity and varying degrees of success. It has had numerous amendments and undergone many modifications, and just as these have had a tendency to reform the criminal and raise his status, they have in that measure been successful. Generally, when offenders are liberated from these institutions now, they are given a certificate of release with the following endorsement upon it: 1st. The power of revoking or altering the license of a convict will most certainly be exercised

in case of his misconduct. 2nd. If, therefore, he wishes to retain the privilege which, by his good behaviour under penal discipline he has obtained, he must prove by his subsequent conduct that he is really worthy of Her Majesty's clemency. 3rd. To produce a forfeiture of the license it is by no means necessary that the holder should be convicted of any new offence. If he associates with notoriously bad characters, leads an idle and dissolute life, or has no visible means of obtaining an honest livelihood, etc, it will be assumed that he is about to relapse into crime, and he will be at once apprehended and committed to prison under his original sentence. The regulations for the enforcement of these conditions in Ireland are, viz.: 1st. Each convict will report himself to the Constabulary station of his locality on his arrival in the district, and subsequently on the 1st of each month. 2nd. A convict must not change his locality without notifying the same at his Constabulary station, in order that his registration may be changed to the locality to which he is about to proceed. 3rd. An infringement of these rules by the convict will cause it to be assumed that he is leading an idle and irregular life, and thereby entail a revocation of his license. In order to assist an effective supervision over this class great care is taken to have a complete registration, and every means possible is taken to insure identification, photography assists in this, and every male prisoner now entering these establishments has his photograph taken, as well as full particulars under which he is in custody, particulars as far as known of former convictions, and a complete description is taken of hair, eyes, height, age, trade or calling, where born, where friends reside, etc. A constant and systematic correspondence is kept up with governors of gaols and with the police throughout the country in order that criminals may be identified.

The education and training given in reformatory institutions would, without the assistance of conditional liberation and registration, be of themselves incomplete, so on the other hand without education and training, conditional liberation would be incomplete and unsatisfactory in its results. The system must be taken as a whole to be of value. It should be felt, that each criminal, previous to his liberation, has been invited to co-operate in his improvement, and that he has been made aware of the stringent course which will be pursued towards him after his liberation.

If it be an objection that this system would create too much espionage, I reply without hesitation, that it would only be under very faulty arrangements that such a result could ensue. Espionage is the consequence of the appearance of suspicious characters, of whom the police know but little, and imagine very much. Authentic information, accompanied by systematized and responsible police proceedings, preclude abuse. Why? Are we to show sympathy with those persons who apply the term "liberty of the subject" to the cases of "habitual offenders against the law?" The liberty of the subject, so construed, would soon become the bondage of the honest man. The idea of punishment is still retained, and offenders sentenced to definite periods of imprisonment as "punishment." They are still branded "convicts," and while this "stigma" attaches it prevents their absorption in the community. Until this be done they must ever remain a distinct class. I think this is a grievous hardship and deserves serious consideration. It is of the utmost importance to have full and accurate information of criminals and liberated offenders, and this can be had only through the police. It has been abundantly proved that this information cannot be obtained by a police system managed by a number of municipal corporations. It must be obvious to all that the police systems on this continent are notoriously defective; if such was not the case, there would be no need for calling into existence and maintaining a separate system of private detectives to undertake work that should be more speedily and effectively done by the regular force, if properly selected, organized, trained and managed from a central authority.

I have endeavored to show: 1st. That the idea of punishment ought to be abolished unless for the most heinous crimes. 2nd. That a comprehensive reformatory scheme might be introduced, yielding beneficial results to the community at a greatly reduced expenditure of money than is now required to administer punishments that only yield results that are inimical to the public weal. 3rd. That our present establishment, now used for the administration of punishment, could be modified to meet this exigency at small expense. 4th. That employment could be provided so that the products accruing from these establishments would not injuriously compete with free labor. It is pertinent to ask: What difficulty, if any, stands in the way, preventing the undertaking and of accomplishing this work? It cannot be the want of sympathy, for the

community overflows with public philanthropy, as may be witnessed by the numbers of men and women and the millions of dollars sent annually to distant countries to aid the work of reformation. It cannot be the lack of courage, for it has ever been when the community have been threatened, either by internal or external foes, there was no lack of volunteers ready to endure fatigue, encounter difficulties, or face dangers, to avert the calamity. We might expect that grand juries should take notice of this reform in their presentments. It receives no attention from the committees of corporations when they meet to examine the accounts incurred for the maintenance of the gaols. They may pass them with a grudge, but they pay the bills. This reform is not taken up by legislative bodies as claiming their attention, unless it be demanded and urged upon them by their constituents, or it may be considered by them as not affording a good election cry! It has not been taken up by prohibitionists, although intemperance is so intricately and completely involved with this subject that they cannot be properly considered apart. If we were able to enforce temperance, and thereby somewhat reduce crimes, we would intensify the remainder and render it almost impossible of detection. The press pass it by, apparently considering it to be their mission only to collect and disseminate information on such topics or subjects as the public demand of them. Whenever the public evince a desire for information, and urge a discussion of this matter, there need be no fear of the press failing to do its duty. Is it not surprising that this needed reform has not hitherto been urged from our pulpits? Is it not a fit theme? By adopting this reform, would we not be obeying the command to love our neighbors as ourselves? Would it not be doing unto others as we would they should do unto us? Let us hope the time is not distant when this reform will find an able and earnest advocate in every pulpit, and that it will form a plank in political platforms, until such time as the administration of justice in this dominion be so tempered with mercy and the spirit of forgiveness that it will open up a clear way for the unfortunate, or even the wicked, to be fitted to return as useful members of the community.

ANNUAL REPORT

—OF THE—

HAMILTON ASSOCIATION

For the Promotion of Literature, Science and Art.

(Read at the Annual Meeting, held May 17th, 1888).

The work of the Association has been vigorously carried on during the past year. Eight meetings of the General Association has been held, at which the following papers have been read and discussed, viz.:

"Evolution," by the President, Rev. Samuel Lyle, B. D.

"The Mahabaratta," by H. B. Witton, Sr.

"Notes on Primitive Man," by William Kennedy.

"Atmospheric Pressure," illustrated by experiments, by Alexander Gaviller.

"Notes on the Waverley Novels," by the Rev. C. H. Mockridge, D. D.

"How to Study Botany," by T. J. W. Burgess, M.D., F.R.S.C.

In addition to these meetings the various sections of the Association have had several meetings and done a considerable amount of original work; especially has this been the case with the Biological Section, where botany, entomology and ornothology have chiefly engaged the attention of the members of the Section. In connection with the former of these a great impetus has been given to the pursuit of this science by Dr. Burgess becoming connected with the Association and infusing the members with his enthusiasm. In entomology, one of our members, John Alston Moffat, a member of the council of the Entomological Society, has contributed a list of no less than 145 names of Lepidoptera, which he has added to the Canadian Lepidoptera. In Mr. McIlwraith, who is chairman of the

Section, we have the subject of ornithology well represented. His "Birds of Ontario," which was published in our last volume of proceedings, as well as papers contributed by him during the past year, show that this branch of biology has not been neglected.

The Biology Section meets on the first and third Fridays of every month, at which one or more papers of a thoroughly practical and largely original character are read. In addition to this, the members of the Section call attention at each meeting to the observations made by them during the periods between.

The Section purposes holding weekly field meetings during the summer, and a monthly meeting to compare notes.

The interest in the Association and its work is maintained, and the membership keeps up, the number at present on the roll being 145.

The officers for the ensuing session are:—

President, Rev. Samuel Lyle, B. D.

1st Vice-President, T. J. W. Burgess, M. D.. F. R. S. C.

2nd Vice-President, W. A. Child, M. A.

Recording Secretary, A. Alexander.

Corresponding Secretary, H. B. Witton, Jr., B. A.

Treasurer, Richard Bull.

Curator and Librarian, Alexander Gaviller.

Council:—J. Alston Moffat, B. E. Charlton, William Kennedy, James Leslie, M. D., T. W. Reynolds, M. D.

A. ALEXANDER,
Secretary Hamilton Association.

TREASURER'S REPORT.

1887-8.

Read before the Annual Meeting, held 17th May, 1888.

Hamilton Association in Account with R. Bull, Treasurer.

RECEIPTS.

Balance		$ 70 33
Government Grant		400 00
Subscriptions		158 00
Sale of Transactions		19 20
		$647 53

EXPENDITURE.

Rent	$ 250 00	
Books	26 50	
Printing, Postage and Stationery	264 60	
Furniture (cases)	16 50	
Light	8 08	
Insurance	12 50	
Carriage on Specimens	5 82	
		584 00
Balance in hand		$ 63 53

(Signed) R. BULL,
Treasurer.

W. H. BALLARD, } *Auditors.*
A. T. NEILL, }

REPORT OF CURATOR AND LIBRARIAN.

FOR SESSIONS 1886-7 AND 1887-8.

THE HAMILTON ASSOCIATION EXCHANGES WITH THE FOLLOWING SOCIETIES AND PERIODICALS:

Publications of the Provincial Government.
Geological and Natural History Survey of Canada, Ottawa.
The Canadian Royal Society, Montreal.
Entomological Society of Ontario, London.
Brockville Society of Natural History.
Canadian Institute, Toronto.
Canadian Record of Science.
Historical and Scientific Society, Winnipeg, Manitoba.
Nova Scotia Society Institute.
New Brunswick Geological and Natural History Survey.
Nova Scotia Society Institute of Natural History.
Royal Colonial Institute.
Fruit Growers' Association, Ontario.
Psyche Monthly Publication.

UNITED STATES.

Harvard University Library, Mass.
Harvard Comparative Zoology, Mass.
Harvard Geological Series, Mass.
New York Microscopical Society, New York.
Peabody Academy of Science, Salem.
American Academy of Science, New York.
The Elisha Mitchell Society Journal.
John Hopkin University Journal.
American Academy of Science, St. Louis.
American Geographical Society.
The Conchologists' Exchange, Philadelphia.

INDIA AND AUSTRALIA.

Bengal Asiatic Society.
The Natural History of Victoria, with colored plates, Melbourne.

GREAT BRITAIN.

Manchester Geographical Society.
Manchester Geological Society.
Scottish Geographical Society.
Glasgow Geological Society.
Edinboro' Geological Society.
Cornwall Mining Association.
Royal Society, London.
Honorable Cymmrodovian Society, London.
Pharmaceutical Journal, London.
The Colonies and India Journal.

THE FOLLOWING DONATIONS HAVE BEEN MADE TO THE MUSEUM:

Three earthen lamps from Pompeii.
Photographs of two bodies found in Pompeii.
Pavement from a house in Herculaneum.
Carbonized wood from the house of Aristides at Herculaneum.
Specimen of Mosaic pavement from the house of the Faun at Pompeii.
Piece of Alabaster from the Temple near the Sphinx.
Petrified wood from Cairo.
Two lamps from Memphis.
Three small tools from Memphis.
Three lachrymatoræ (or tear) bottles from an Etruscan tomb.
Small idol from tomb near the Pyramids of Cheops.
Part of a Roman brick.
Glass work from Venice.
Shells from sea shore of Joppa.
An ancient tile from Jerusalem.
Piece of Pavement from Jerusalem.
Alabaster vase for ointment.
Olive branch from Garden of Gethsemane and cone from cypress tree in ditto.

A branch and cone from a cedar in Lebanon.

Shells from the rock on which the Great Pyramid stands.

Lava with copper coin in it from Mount Vesuvius.

Pavement from Roman theatre at Florence.

Specimen of the sulphur from the bath of Nero at Pozzoli.

Scarabæ from Egypt.

A number of Roman and Egyptian coins.

The above presented by Mrs. Charlton, of Hamilton.

A very fine head of the mountain sheep, from the Rocky mountains. Presented by Mr. W. Hunter, of British Columbia, through F. E. Kilvert, Collector of Customs.

A part of clothing of a British soldier slain at the Battle of Stoney Creek, 1813, consisting of gold braid on cloth and some of the buttons belonging to the same. The same from the battle field of Lundy's Lane. Presented by Mr. C. Blachford, Hamilton.

Two swords from the sword fish. Presented by T. Burrows.

Seven models of hulls of British ships of war. Fourteen copper and four silver English coins and gilt cast of an English spade guinea. One very fine specimen of native copper from Cornwall, England. Presented by S. Symmons.

Twelve mineral specimens from the Northwest. Presented by A. Mckay, M. P.

Collection of mineral specimens from Ontario. Presented by A. E. Walker.

Specimen of magnetic iron from magnetic cave, Arkansas, U. S. Indian wampum from Township of Beverly. Presented by D. Boyle.

Specimen (in bottle) of singing sand from Manchester, Mass., U. S. Presented by Mrs. N. Mills.

Two curious dried botanical specimens.

A quantity of fossils from near Hamilton. Presented by Col. Grant.

A quantity of fossils and minerals from Hungary. Presented by Mrs. Greene.

A pair of buffalo horns from the Northwest.

Flint arrow heads from Hinda's cave in Sheffield, Co. of Cobert, Alabama, U. S. Presented by Maslio Powell.

Four photographs of the members of the Association picnic, held in the glen at Dundas. Presented by B. E. Charlton.

Three photographs of the members of the Association picnic, held in the glen at Dundas. Presented by Dr. Gaviller.

Three photographs of the members of the Association picnic, held in the glen at Dundas. Presented by Mrs. Stewart.

Specimens of Canadian woods, cut and polished. Presented by Messrs. J. Hoodless & Son, Messrs. Flatt & Bradley, Mr. Jones, and Messrs. Sawyer & Co., all of the City of Hamilton.

An old atlas of Newfoundland, Labrador and Gulf of St. Lawrence, published in London, 1779. An atlas of thirty-five maps, published in London, 1725. Presented by Mr. J. H. Killey, Hamilton.

Sixty maps of the United States survey of the lakes of America. Presented by Adam Brown, M. P.

Bottle containing specimens of a cuttle fish, centipedes and spiders (in spirits) from Nassau. Presented by Herbert Mortimer.

ANNUAL REPORT

—OF THE—

Biological Section, i.e. Botany and Zoology

HAMILTON ASSOCIATION,

SESSION 1887-1888.

T. McIlwraith, Chairman. T. W. Reynolds, M. D., Secretary.

The section was organized at a meeting held in the Library, Nov. 23rd, 1887, when the officers were elected.

At this meeting it was decided that during the winter, meetings should be held on the first and third Fridays of every month, that a paper should be presented at each meeting, to be as far as possible of a practical character, and that the members should also bring before the meetings notes and inquiries on matters of interest in connection with the work of the section.

At the meeting held on February 17th, 1888, the following order of business was adopted and has since been followed:

1.—Reading minutes of last meeting.
2.—Amending, if necessary, and sanctioning the same.
3.—Remarks on papers of previous meeting.
4.—Communicating items of interest.
5.—Transaction of business arising out of minutes (this will include answers to questions asked at previous meetings).
6.—Notice of a desire for information on a subject named by the enquirer to lay over till next meeting.
7.—Reading of papers and remarks on same.
8.—Announcing business for next meeting.

The work of the section has so far been of a theoretical character, still the papers have all been more or less practical, and most

of them illustrated by specimens. As a good average attendance was maintained at the meetings, it is to be hoped that a good foundation has been laid and that good practical work will be the result of the session's labor. The following is the programme of papers, etc., presented during the winter:—

Dec. 2, 1887.—"A Biography of the Only Known Carnivorous Larva of a Butterfly." An account of the habits of the Fenesica Tarquinius, with specimens of the chrysalis and butterfly.—J. Alston Moffat.

Dec. 16, 1887.—"Orchids." Description of the general and local varieties, with specimens of the Canadian varieties.—T. J. W. Burgess, M. D.

Jan. 6th, 1888.—"Economic Ornithology." A paper dealing particularly with the English sparrow, its productiveness, and the mischief it is guilty of, in the way of destroying buds, grain and seeds, and driving away song and insectivorous birds.—T. McIlwraith.

Jan. 20, 1888.—"Arboreal Habits of Some of our Native Snakes."—J. Alston Moffat. "Plant Color, and Fertilization by Insects."—A. Alexander.

Feb. 3, 1888.—"Field Notes of a Winter Holiday Trip, during Jan., 1888, to Aiken, S. C.," illustrated by specimens collected there. —T. W. Reynolds, M. D.

Feb. 17, 1888.—"The Mystery in the Life History of Danais Archippus." An account of the formation and migration of flocks of the common milkweed butterfly.—J. Alston Moffat.

March 2, 1888.—Discussion on the analogy between the circulation of sap in trees and the blood in animals. "Notes on the History of Botany."—T. J. W. Burgess, M. D., F. R. S. C.

March 16, 1888.—Discussion on the fertilization of plants by insects. "Notes on Birds of Paradise," with specimens.—T. McIlwraith and T. W. Reynolds, M. D.

April 6, 1888.—"Notes on the Flora of the 49th Parallel, from the Lake of the Woods to the Rocky Mountains." Observations made while serving as Surgeon and Botanist on H. M. British North American Commission, with specimens of the most peculiar and beautiful plants.—T. J. W. Burgess, M. D., F. R. S. C.

April 20, 1888.—"Notes on the Birds seen during the Winter of 1887-8," with specimens.—T. McIlwraith.

May 4, 1888.—"Some Inquiries about the Inception of the Young of the Marsupials."—J. Alston Moffat. "A List of 145 Named Canadian Lepidoptera."—J. Alston Moffat.

As an example of the good that has and can be done by this and other Sections, it may be mentioned that Mr. McIlwraith's paper on Economic Ornithology has been published in the *Farmer's Advocate* and has also been read at the meeting of the Fruit Growers' Association in Ottawa, in February, 1888, with the result that a committee was appointed to secure the necessary legislation to restrict the increase of the English sparrow.

It will be also noticed that Mr. Moffat has made a valuable contribution to Entomology in his List of Canadian Lepidoptera, which has been presented to the Association.

During the summer season, it is the intention that Sectional field-days should be held, as well as those held by the Association in general; also that the members should meet once a month for the purpose of comparing notes on specimens gathered during the intervening time by members on their own account, and hearing the results of their observations in general, on matter connected with the Section's work. These monthly meetings will also be open for general business connected with the Section, similar to that transacted at the winter fortnightly meetings.

ENTOMOLOGICAL DEPARTMENT.

REPORT BY J. ALSTON MOFFAT, MEMBER OF THE COUNCIL OF THE ENTOMOLOGICAL SOCIETY OF ONTARIO.

I herewith present the names which I have added to the list of Canadian Lepidoptera during the period of my collecting, as far as I have been able to procure them to the present time. I have quite a number of specimens still unnamed, some of which may yet prove to be new to Canada.

The gentlemen to whose kindness I am mostly indebted for the identification of my material are:—

Mr. W. H. Edwards, of Colburgh, W. Va., who is carrying forward a most laborious and important work in breeding from the egg, and describing the preparatory stages of the butterfly, and whose "Butterflies of North America," as it issues from the press, excites more and more the admiration of all who are interested in the Diurnals for its thoroughness and the truthfulness of its illustrations to nature.

A. R. Gröte, M. A., formerly of Buffalo, now of Breman, Germany, who has long made a special study of the Noctnidae, but has also an extensive knowledge and experience of the science generally. I mention as an illustration of how young the science is yet on this continent, that he has named a large proportion in this department.

The Rev. Geo. D. Hulst, of Brooklyn, N. Y., editor of *Entomologiea Americana*, who has the largest collection of North American Geometers in the world.

Prof. C. H. Ferland, M. A., of Amherst, Mass., who has thoroughly qualified himself to take the first rank as an authority on Micro-Lepidoptera on the continent, not only by the study of the large amount of material at his disposal at home, but also by travel for the examination of the best collections in Europe, such as that of the British Museum, Lord Walsingham and Prof. Zeller, thereby informing himself of all that had been done in that particular line before him.

BUTTERFLIES.

DIURNES.

1. Pamphilia dion, Edw.
2. Pamphilia viator. Edw.
3. Endamus electra, Lintn.

MOTHS.

ZYGENIDEÆ.

4. Harrisina americana, Harr.

BOMBYCIDÆ.

5. Limacodes cæsonia, Grote.
6. Sisyrosea inornata, G. & R.
7. Adoneta spinuloides, H -S.
8. Packardia geminata, Pack.
9. Apatelodes angelica, Gr.
10. Heterocampa marthesia, Crm

NOCTUÆ.

11. Anytus sculptus, Gr.
12. Arzama diffusa, Gr.
13. Parastichtis perbellis, Gr.
14. Scopelosoma Græfiana, Gr.
15. do Moffatiana, Gr.
16. do ceromatica, Gr.
17. do vinulenta, Gr.
18. Lithophane signosa, Gr.
19. do querquera, Gr.
20. Lithophane Thaxteri, Gr.
21. Catocala Levettei, Gr.
22. Allotria Elonympha, Hub.
23. Panopoda carnicosta, Guen.
24. Antiblemma Canalis, Gr.
25. Spargoloma Umbrifascia, Gr.
26. Renia restrictalis, Gr.
27. Hypena vellifera, Gr.

GEOMETRIDÆ.

28. Caberodes majoraria, Guen.
29. Endropia marginata, Minot.
30. do textrinaria, Grote.
31. Anagoga pulveraria, Linn.
32. Ephyra pendulinaria, Guen.
33. Asthena luctata, Guen.
34. do albogilvaria, Morr.
33. Calledapteryx Dryopterata, Gr.
36. Deilinia variolaria, Guen.
37. Semiothisa minorata, Pack.
38. Phasiane mellistrigata, Grote.
39. Thamnonoma brunneata, Tn.
40. Cymatophora umbrosaria, Hb
41. Heterophleps Harveiata, Pk.
42. Lobophora anguilineata, Gr.
43. do montanata, Pack.
44. Petrophora prunata, Linn.
45. do lunigerata, Walk.

PYRALIDÆ.

46. Chalcoela, Robinsonii, Gr.
47. Scoparia libella. Grote.
48. Botis unimacula, G.-R.
49. do quinquelinealis, Gr.
50. do venalis, Gr.
51. Pilocrocis ramentalis.
52. Crocidophora serratissimalis, Zell.
53. Blepharomastix, ranalis, Gn.
54. Eudioptis Hyalinata, Linn.
55. Diathraustra actomaculalis, Fernald.
56. Margarodes quadristigmalis, Guen.
57. Paraponyx plenilinealis, Gr.
58. Nymphaella dispar, Gr.
59. Homophysa albolineata, G-R
60. Cryptolechia tentoriferella, Clem.
61. Tetralopha asperatella, Clem.
62. Nephopteryx ovalis, Pack.
63. do undulatella, Cl.
64. Phycis angusella, Zell.
65. Salebria fusca, Haw.
66. do contatella, Grote.
67. Meroptera Pravella, Grote.
68. Ephestia interpunctella, Hub.
69. do ochrifrontella, Zell.
70. Crambus, sericinellus, Zell.
71. do alboclavellus, Schl.
72. do topiarius, Zell.
73. do elegans, Clem.
74. do caliginosellus, Clm.
75. do fnscicostellus, Zell.
76. Propexus pexellus, Kad.
77. Schoenobius longirostrellus, Clem.
78. Schoenobius Clemensellus, Robs.

TORTRICIDÆ AND TINEADÆ.

79. Teras subnivana, Walk.
80. do maculidorsana, Clem.
81. do Logiana, Schiff.
82. do americana, Fern.
83. Cacœcia infumatana, Zell.
84. do fractivittana, Clem.
85. Loxotænia virescana, Clem.
86. Pandemis lamprosana, Rob.
87. Lophoderus triferana, Walk.
88. do politana, Haw.
89. Tortrix Pallorana, Robs.
90. do quercifoliana, Fitch.
91. Tortrix Fumiferana, Clem.
92. Amorbia humerosana, Clm.
93. Œnectra xanthoides, Walk.
94. Œnectra irrorea, Robs.
95. do violaceana, Robs.
96. Cenopis reticulatana, Clem.
97. do Groteana, Fern.
98. Dichelia caryæ, Robs.
99. Amphisa discopunctana, Cl.
100. Platynota exasperatana, Zell.
101. do sentana, Clem.
102. Conchylis straminoides, Gr.
103. do dorsimacnlana, Robs.
104. Eudemis botrana, Schiff.
105. Eccopsis nitidana, Clem.
106. do concinnana, Clem.
107. do fasciatana, Clem.
108. do exoleta, Zell.

109. Eccopsis inornatanna, Clem
110. do Footiana, Fern.
111. Penthina hebesana, Walk.
112. do chionosema, Zell.
113. Sericoris agilana, Clem.
114. do fuscalbana, Zell.
115. Paedisca transmissana, Wk.
116. do Scudderiana, Clem.
117. do dorsisignatana, Cl.
118. Semasia formosana, Clem.
119. Proteoteras Moffatiana, Fern MSS.
120. Steganoptycha nubeculana, Fern. MSS.
121. Phoxopteris nubeculana, Cl
122. do semiovana, Zell.
123. do dubiana, Clem.
124. do angulifasciana, Zell
125. Depressaria atroclossella, Cl.
126. do applana, Fab.
127. Semioscopis allenella, Wlsm.
128. Epigraphia eruditella, Gr.
129. Semioscopis inornata, Wlsm.
130. Anesychia texannella, Cham.
131. Choreutis leucobasis, Fern, MSS.
132. Œcophora argenticintella, Cl.
133. Gelechia innocuella, Zell.
134. do flavocostella, Clem.
135. do agrimoniella, Clem.
136. do bicostimaculella, Ch.
137. Plutella cruciferarum, Zell.
138. Bucculatrix pomifoliella, Cl.
139. Adelia purpurella, Walk.
140. Dasycera newmanella, Clem.
141. Ypsolophus pometellus, Fth.
142. Tinea granella, Linn.
143. Chimabacche haustellata, Wlsm.
144. Gelechia roseosuffusella, Cl.
145. Blastobases glandella, Riley.

I append a few notes on some of the species that may prove to be of local interest.

No. 1.—This species was named and described by Mr. Edwards in 1879. See *Canadian Entomologist*, Vol. 11, No. 12, Page 238, where he says: "This species is closely allied to Arpa Bd. and Lec. I formerly received Dion from Mr. G. M. Dodge, Nebraska, and supposed it to be Arpa. This season I have received the species from the southern shore of Lake Michigan, in Indiana, from Mr. Chas. E. Worthington; also from Mr. J. Alston Moffat, of Hamilton, Ont., who says it inhabits one locality there. It would appear then to occupy a belt extending from Canada to Nebraska.' I had been taking it for several years before that, and was always expecting to meet with some one that knew it and would give me its name. I at length got tired waiting and sent it to Mr. Edwards a month or two after he had named it. The locality referred to above is the marsh at the north end of Beasley's Hollow. When the Rifle Ranges were situated there, the Club made a plank walk through the

marsh to the butts, and along that walk I took all my specimens feeding on the flowers within reach, and since that has been removed I have not been able to secure a single one, so exclusively does it appear to be confined to that locality, and I have not heard of another for it anywhere else in Canada.

No. 2.—When Mr. Edwards gave me the name of this species, he wrote: "It is a southern species, and remarkably small; not two-thirds the size of the Louisiana examples." I used to take this one in company with the other during the first half of July, but much more abundantly, and it is equally safe now from my interference as its companion. Capt. Gamble Geddes, of Toronto, has found it plenty near the Humber Plains, 6 miles from Toronto. This is the only other locality I have heard for it in the country.

No. 3.—This species was named and described by Mr. J. A. Lintner, of Albany, State Entomologist for New York in 1881, *Canadian Entomologist*, Vol. 13, No. 4, Page 63, where he says: "Described from a single female received from Mr. W. H. Edwards. The specimen was captured in Hamilton, Ontario, by Mr. J. Alston Moffat, in 1877, in company with another like it, which escaped capture. The detection of the above species is a very interesting discovery for this portion of the United States." When I captured this specimen I did not know that I had secured a prize. It was not until I came to spread it that I saw I had got something quite new. It was flying amidst great numbers of a very common form, which it resembled, and which I thought it was but a very fresh specimen of, consequently the other one I saw I made no special effort to secure, and I have never seen another one since, although searched for carefully in the same locality.

No. 4.—A single specimen taken on Lake Erie shore at Port Dover.

No. 7.—One specimen taken at Ridgeway.

No. 11.—Comparatively common here, but not heard of from any other locality in Canada.

No. 12.—Very considerable interest is attached to this species from its being understood that the larvæ feed inside the stems of water plants. It is but a recent discovery, and its life history is not yet worked out. The catterpillars are found here in early spring in the neighborhood of the marsh, often behind the bark of a decaying stump, where they have hibernated, and where they changed to chrysalids with the first warm weather in spring.

No. 15 —This species was separated from the preceding one by Mr. Grote, in 1882, under the following circumstances: The season of 1877 was one of most unusual abundance for Lepidoptera, all through the season and all over the country. Scopelosoma and Lithophane belong to what are called fall moths, from the fact that they do not appear until the end of summer. They pass the winter in the moth state, pair in the spring and deposit their eggs for the brood that is to appear in the fall again. Being nocturnal in their habits, sleeping through the day on the underside or in a curl of a leaf, I discovered that by striking the branch they would drop to the ground as if dead. If the day is cool they may be picked up by the feet and never show the least sign of life. In this way I secured great numbers of them with little trouble, often returning from a hunt with forty or fifty moths of kinds that had been considered extremely rare. In Nov., 1877, I visited Mr. Grote in Buffalo, to get my new things named, taking with me examples of all that I considered different. There was one kind that I had noticed that seemed to differ much in depth of coloring, so I took what I thought the brightest and freshest specimens and received for it the name of Græfiana. In subsequent year's collecting I noticed that the light form, although with a faded look in contrast with the others, was quite fresh, constant, somewhat local, and not so numerous as the bright ones. I began to suspect that we had two separate moths under one name. Mr. Roland Thaxter, of Cambridge, Mass., who has been a most extensive and successful collector of Noctæids, learning through Mr. Grote that I had secured some rarities, communicated with me with a view to exchange. During our intercourse I communicated to him my suspicions, and sent to him examples of the light form. He replied that he saw no difference in it from what he took. I then sent him the bright form. He was delighted. This was something quite new to him. He inquired if Mr. Grote had seen it. I related the facts as stated above. I then sent to him a good series in both forms, and he went into communication with Mr. Grote about it. The result was that it received a separate name. Mr. Grote clearly states the case in a contribution (on new moths) to the Bulletin of the U. S. Geological and Geographical Survey in this way: "Scopelosoma Moffatiana, N. S. This species, captured in the autumn, on oak leaves, by Mr Moffat, of Hamilton, I have formerly regarded as the same as Græfiana.

Mr. Thaxter calls my attention to the following points: It is generally larger; more richly colored, being a reddish-orange, while Græfiana is yellow; the transverse lines are blackish, not red, and more uneven; the transverse anterior line arched in Moffatiana; the hind wings are suffused with red in the new species, and I find that the mesial line is more even. I have supposed that Moffatiana was fresh, autumnal Græfiana, and figured it as such in my essay, incorrectly. This discovery shows that the type of Græfiana is the fall form, and that it is always to be distinguished from Moffatiana by its yellow ground color, red lines, which are also straighter and, perhaps, thicker, as well as paler hind wings." There are a great many kinds of these fall moths, exhibiting a great diversity of coloring, from a pale yellow to a deep rust brown, corresponding to all the shades of decaying vegetation.

No. 16.—A very rich form, not uncommon here, but much sought after by collectors from a distance, indicating a general scarcity.

No. 19.—A single specimen taken in 1877, and have not met with another since.

No. 21.—Scarce amidst a general profusion of its kind.

No. 22.—An extremely rare and attractive insect. I took one specimen at Ridgeway, and have not heard of another having been taken in Canada.

No. 23.—A pair raised from caterpillars which fed upon oak leaves.

No. 27.—This seems to be one of those insects that is rigidly confined to particular places for some reason, which is apparently at present known only to itself. It is extremely abundant here some seasons, but it has attracted the attention of nearly every entomologist that has examined my collection as being new to them. The Geometers is a very interesting and attractive family, with their broad wings often brightly colored, but one rather difficult to deal with systematically, from the liability of some of the species to vary greatly. Three years ago I turned my attention to the collecting of small moths especially. It proved to be an almost entirely fresh field for investigation, they having been much neglected by Canadian collectors. Since then I have more than doubled the number of known Canadian species, with seventy-six separate forms yet undetermined. The most of these Prof. Fernald has

seen, and, when returning my material on one occasion, remarked upon them, that "some of the unnamed ones are too poor to name; others are unnamed in my collection, and may or may not be new species; and yet others I have not seen before." No one that has not examined them closely can form any idea of the exquisite beauty of many of these tiny creatures, some of them being ornamented with metalic scales of every conceivable hue and brilliancy.

No. 51.—Extremely rare. One specimen taken many years ago. It appears to have a very wide range, as it is reported from Atlanta, Georgia, U. S.

No. 54.—Probably the first specimen of this moth ever taken in Canada was captured in the greenhouse of Mr. T. H. McKenzie, Dundas, and given to me. It had such an uncommon and foreign appearance that we concluded that it must have been brought with some of his tropical plants. Two years after I saw one on the opposite side of the marsh from the cemetery, but failed to secure it. A week later I took one in Mr. Reid's garden on the heights. That same season one was taken at Bartonville, and but one has been taken since that I know of. It propagates on melon vines and is quite plenty in the south.

No. 58.—Taken at Long Point, Lake Erie, From what I have heard I infer that it is nowhere abundant. The sexes differ strikingly.

No. 119.—This moth was found by me for the first time on the 5th of July, 1886. It was an extremely hot day, so I went to the Avenues to enjoy the shade and breeze, if there was any. Whilst strolling on West Avenue, my eye was arrested by a small moth, new to me, on the side of a maple shade tree. It is a rough, mossy green, and so much resembling the moss on the tree that but for its form it might have escaped detection. On that and two following days I took ten In August I went to Buffalo, to the meeting of the A. A. A. S., taking with me a box full of the most attractive of my little beauties, hoping that I might get names for some of them from entomologists present, but they proved to be all new to them, each remarking that I would have to apply to Prof. Fernald. In winter I sent this, with many others, to the Professor, who pronounced it entirely new, described it and named it. Last summer I found it pretty well distributed over the city, always on the trunks of maples. One was taken last summer by Mr. H. S. Saunders, of London, at an electric light there.

No. 138.—Raised from cocoons that were found by Mr. Alexander, our recording secretary, attached to the under side of twigs on his apple trees last spring, and given to me. A very minute form. Dr. W. Brodie, of Toronto, who is well qualified to express an opinion on the subject, when looking at my collection remarked that it had a much more southern appearance than he would have expected from a locality in such close proximity to his own. Many things rare with him, or altogether wanting, seemed to be abundant with me. Vennor used to say that Hamilton had a climate peculiarly its own. There can be little doubt but what Hamilton is situated in a particularly favored spot in many respects, and its fauna and flora attest the fact

ABSTRACT OF PAPERS

—READ BEFORE—

THE BIOLOGICAL SECTION.

ORCHIDS.

BY T. J. W. BURGESS, M. B., F. R. S. C.

(Read before the Biological Section December 16th, 1888.)

In introducing the subject reference was first made to the beauty and singularity of these plants, which often display a wonderful mimicry, it being stated that these peculiar shapes specially adapt them for cross fertilization, very few of them being capable of self-fertilization Reference was also made to the high prices paid for some of the rarer orchids. In their geographical distribution they were said to be spread over the whole world except the polar and desert regions, though they are essentially tropical in their nature. The number of well-distinguished species of orchids is placed by Bentham and Hooker in their "Genera Plantarum" at between four and five thousand. Dr. Gray in 1872 gave 16 genera and 56 species as belonging to the Northern United States; while Prof. Macoun makes Canadian orchids consist of 15 genera and 58 species, some of which, however, are natives of the Pacific coast, and therefore are not included in Gray's Manual. The latest authorities divide the orchids into five tribes, Epidendreæ, Vandeæ, Neottiæ, Ophrydeæ and Cypripedieæ, of which Vandeæ is not represented in Canada. The tribe Epidendreæ includes five genera—Microstylis, Liparis, Calypso, Aplectrum, and Corallorhiza; Neottiæ, seven genera—Listera, Spiranthes, Goodyera, Arethusa, Calopogon, Pogonia and Epipactis; Ophrydeæ, two genera—Orchis and Habenaria; and Cyripedieæ only one—Cypripedium. *Microstylis* contains three species, M. monophyllos and M. ophioglossoides which

range from Nova Scotia to Lake Winnipegosis, and M. diphyllos confined to the northern Pacific coast. *Liparis* contains but one species, L. Loesellii, which ranges from Nova Scotia to the Saskatchewan. *Calypso* consists of but C. borealis, found from the Atlantic to the Pacific. *Aplectrum* is also restricted to one species, A. hyemale, occurring from Ottawa to the Saskatchewan. Of Corallorhizas we have five species, two of them C. innata and C. multiflora, stretch from the Atlantic to the Pacific, and are recorded by Judge Logie as occuring at Hamilton; C. striata has the same western range, but does not extend east of Ottawa; C. Mertensiana is confined to the coniferous woods west of the Rockies. C. odontorrhiza is doubtful except in south-western Ontario. Both our *Listeras*, L. cordata and L. convallarioides are faiıly common from Cape Breton to British Columbia, but neither of them have been found about Hamilton. Of the genus *Spiranthes*, S. latifolia has only been found occasionally in Nova Scotia, New Brunswick and Ontario; S. Romanzoviana is not uncommon right across the continent; while S. cernua and S. gracilis start at Nova Scotia and end respectively at Georgian Bay and the Mackenzie river. S cernua is the only one recorded for this neighborhood, having been found by Judge Logie at The Dell, Ancaster. *Goodyera* contains three species, of which G. repens is found right across the continent; G. pubescens reaches from Nova Scotia to Lake Superior, and is noted by Judge Logie as occurring at the Sulphur Springs near Ancaster; while G. Menziesii extends from Lake Superior to the Pacific. *Arethusa* is confined to one species, A. bulbosa, which occurs from Nova Scotia to London, Ont. *Calopogon* is also limited to one species, C. pulchellus, which ranges from Cape Breton to Lake Huron. Of Pogonias we have three in Canada, P. ophioglossiodes, whose range is almost identical with Calopogon, and which was found by Judge Logie at Millgrove; P. pendula, probably to be found in south-western Ontario, although the author has never seen a Canadian specimen; and P. verticillata, for which our only known station is Komoka, Ont., about 6 miles west of London, where it was found by Mr. Saunders and the author in 1879. *Epipactis* is represented only by E. gigantea, confined to the west of the Rockies. *Orchis*, as now constituted, includes three species, one of which, O. rotundifolia, is the Habenaria rotundifolia of Gray's Manual, thus relegated back to its original genus; it is found from Anticosti, strangely neglecting Nova Scotia and New

Brunswick as far as yet known, westward to British Columbia, and is given in Logie's Hamilton list as occurring at Galt. O. spectabilis is found from New Brunswick to the Detroit river, and is catalogued by Logie as occurring at Hamilton; while the third, O. aristata, is a Pacific coast plant. *Habenaria* includes no less than twenty-one of our fifty-eight species. Of these, H. ciliaris was discovered by the author in 1886 near Leamington, in Essex county, the only Canadian station; H. blephariglottis extends from Nova Scotia to Lake Island, Lake Joseph, Muskoka, Ont.; H. leucophæa and H. lacera, from Nova Scotia to the neighborhood of London, Ont.; H. psycodes, from Nova Scotia to the Kaministiquia and Rainy rivers; H. fimbriata, from Nova Scotia to Hamilton, Ont.; H. chorisianus, H. gracilis, H. sparsiflora, and H. leucostachys are confied to the North-west coast and British Columbia; H. tridentata is common from Nova Scotia to Lake Superior; H. virescens is confined to Ontario; H. bracteata (H. viridis, var. bracteata of the Manual), occurs from New Brunswick to Vancouver Island; H. hyperborea abounds from the Atlantic to the Pacific; H. dilatata is rather common from Cape Breton to the Rockies; H. elegans and H. Menziesii are confined to the North-west coast; H. Unalaschensis, found in the same localities, has only been noted on this side of the Rockies at Anticosti and the Fishing Islands on Lake Huron; H. obtusata is found from Nova Scotia to the Pacific coast, extending into Alaska; H. Hookeri is found from Cape Breton to the north shore of Lake Superior; and H. orbiculata from the Atlantic to the Columbia River, B. C. Nine of these species, viz,, H. fimbriata, H. leucophæa, H. psycodes, H. tridentata, H. virescens, H. bracteata, H. hyperborea, H. Hookeri, and H. orbiculata are referred by Logie to the neighborhood of Hamilton. The last and best known genus, *Cypripedium*, has eight species; C. montanum, confined to the Pacific slope; C. passerinum, ranging from James' Bay and the Pic River to the Rocky Mountains and Yukon River; C. guttatum, said to be abundant in Unalaska, also gathered at Fort Franklin on the Mackenzie River; C. acaule, occurring from Nova Scotia to Lake Superior and the Mackenzie River, also, according to Logie, at Millgrove, Ont.; C. arietinum, ranging from the Saguenay River to the Portage of the Grand Rapid of the Saskatchewan River; C. parviflorum, rather common throughout Canada to Lake Winnipeg and the Rockies; C. pubescens, common from Nova Scotia to the base of the Rocky Mountains; and C

spectabile, often abundant from Cape Breton to the extremity of the Bruce Peninsula. The last three are mentioned by Logie as occuring in the neighborhood of Hamilton.

NOTES ON THE HISTORY OF BOTANY.

BY T. J. W. BURGESS, M. B., F. R. S. C.

(Read before the Biologioal Section, March 2nd, 1888)

Botany was defined by the author as the natural history of the vegetable kingdom, but it was stated that while in its widest sense it embraces everything respecting plants, their nature, their kind, the laws which govern them, and the uses to which they may be applied in medicine, chemistry or the arts in general, yet it is commonly restricted to a knowledge of the plants themselves, their mode of growth, their anatomical and physiological phenomena, and those characteristic marks by which the various species may be distinguished, the one from the other.

Some reference having been made to the various superstitions held by the ancient herbalists as to the virtues, etc., of plants, the history proper of botany was taken up, and was divided into four great epochs. The first of these—the ancient—embraces the period extending from the Creation to the destruction of the Western Empire by the Goths and Vandals, which peoples, nursed in war, abhorred the arts and sciences, believing they gave rise to effeminacy. Besides the various allusions by biblical authors, Anaxagoras, Pythagoras, and other ancient Greek philosophers wrote during this period, though the only vestige of the botanical knowledge of the earliest ages that we have in secular literature is to be found in Homer, Aristotle's treatise, though published about 384 B. C., being lost. The proper historical era begins about 300 B. C., and we have treatises published by Theophrastus, Dioscorides and Pliny between then and the end of the ancient epoch. The second, or Arabian epoch, began about the close of the 8th century, when ancient botany began to reappear among the Saracens, who, though at first disposed to be contemptuous of science, as shown by their destruction of the Alexandrian library, now became imbued with a love of it, and a succession of Caliphs, amongst whom was the famous Haroun Alraschid, by

their fostering care of learning and learned men, made Bagdad the most enlightened city of the world. Serapion, Rhazis, Avicenna, Averhoes, Actuarius, Plato Apuleius and Abenguist were the principal writers during this period. With the beginning of the 16th century we enter upon the third epoch—the artificial—during which the artificial arrangement of plants flourished, a period adorned by such names as Cæsalpinus, Morrison, Ray, Tournefort, and the immortal Linnæus. About 1536 the first modern botanical garden was established in Italy by Brasavola; while the first work founded on actual observation was issued by Otho Brunfels, of Mentz, in 1530. In 1560, Conrad Gesner, of Zurich, first proposed an arrangement of plants from the parts of the flower and fruit, the first application of this idea being made by Cæsalpinus in 1583. In 1680, Morrison published his great work, "The Universal History of Plants," Ray's work being published two years later, and Tournefort's in 1694. Linnæus, who was born May 23rd, 1707, published his system in 1735, his great work, "The Species Plantarum," being published in 1753. He died Jan. 10th, 1778. With the death of Linnæus the artificial epoch closes and the natural is entered upon. The fame of being called the founder of the natural system has fallen to Antoine Laurent de Jussieu, whose work, published in 1789, first established natural orders of plants. The next great systematist was De Candolle, whose work was published in 1805, the second great botanical work of this century being the "Genera Plantarum" of Bentham and Hooker. Many other distinguished writers were mentioned in the paper, but most especially the late Prof. Asa Gray.

NOTES ON THE FLORA OF THE FORTY NINTH PARALLEL, FROM THE LAKE OF THE WOODS TO THE ROCKY MOUNTAINS.

BY T. J. W. BURGESS, M. B., F. R. S. C.

(Read before the Biological Section, April 6, 1888.)

This paper consisted of field-notes made by the author while serving as Surgeon on H.M.N.A.B. Commission, which was appointed for the purpose of defining the boundary between Canada and the United States, from the Lake of the Woods westward to the Rocky Mountains, the time occupied in the work being about three

years. This territory has for its eastern boundary the Laurentian highlands, which extend north of the River St. Lawrence and the Great Lakes, from Labrador to the Lake of the Woods, and for its western the Rocky Mountains. It presents three well marked levels or prairie steppes, and may be said to slope gradually eastward. The first level includes the valley of the Red River and region about the Lake of the Woods, and is limited to the west by the more or less abrupt edge of the second prairie level, which forms an escarpment known as Pembina Mountain. Of the Lake of the Woods region, but a small proportion is suitable for agricultural purposes. The northern and eastern shores are almost entirely composed of barren rock. Only here and there, as on Garden Island and at the north-west angle, is there a small area capable of cultivation. Pine (Pinus resinosa) of fair growth occurs in some localities, but swamp elm (Ulmus Americana), poplar (Populus tremuloides), cedar (Thuja occidentalis), spruce (Abies nigra and balsamea), and birch (Betula papyracea), are the most prominent trees. The greater part of the southern and western margins of the lake are equally useless, and are of a forbidding aspect, the immediate border being here formed of a low ridge of sand, barely held together by the roots of various grasses, behind which is generally a stretch of grassy swamp and lagoon, varying from a mile to two miles in width, and bordered by a forest of tamarack (Larix Americana) occupying a soil but little less swampy. The flora of this district resembles that of the Laurentian region north of the St. Lawrence river, and differs completely from that of the prairie country to the west. Of the district covered by the notes it is par excellence, the home of water and moisture-loving plants. The ferns found were also almost entirely confined to this district. West of the Lake of the Woods is an extensive and very generally swampy region which extends in a breadth of from 50 to 75 miles to the eastern edge of the alluvial prairie of the Red River, the flora being much the same as that in the immediate vicinity of the lake. On the Red River Prairie proper is first found a mingling of the plants of the plain with eastern and northern woodland ones. True western plants are still in the minority, while some eastern weeds are seen, fore-runners of an advancing civilization. The soil is uncommonly fertile, being a dark, rich mould, for a depth of from two to four feet, small swamps being scattered uniformly over its surface, but generally so situated as to be easily

drained into the Red River or some of its tributaries. The wooded area is small, only the streams being fringed, but some of the trees attain a large size. The front of the escarpment known as Pembina Mountain and its summit forming the edge of the second prairie steppe are in places thickly wooded, there being more or less timber found for some twenty miles westward to Pembina River, on crossing which the great treeless plain is entered on. No woods now appear except along the valleys of the streams, and even the shrubs are stunted. About the base of Turtle Mountain, which is about 20 miles square, and 500 feet high, the prairie commences to re-clothe itself with timber. Not far from here was seen the first saline lake, a common feature further west. It had not the thick skirting of grasses and sedges of other ponds, but instead a vivid scarlet fringe of Salicornia herbacea. Westward from Turtle Mountain to the Souris River, 170 miles from Red River, the prairie is almost level. Le Grand Coteau or Great Coteau of the Missouri, distant from Red River about 300 miles, forms the eastern edge of the third prairie steppe. It is perhaps the most remarkable monument of the glacial period now existing on the western plains. Its average width is about 45 miles, and its eastern edge is about 150 feet above the level of the second prairie steppe. It presents a confusion of hills, among which are basin-like valleys, without outlet, generally holding swamps or ponds, often saline in character. The greater part of the Coteau is but little better than a barren desert; but west of it a well-defined table land stretches as far as White Mud River, about a hundred miles, which, though little fit for agricultural purposes, is well adapted for pasture; along its edges are sheltered ravines containing groves of poplar, and beneath it are vast deposits of lignite coal. In parts of it we find some of the most peculiar western plants. Beyond this plateau an arid plain stretches to the Milk River, while west of the Milk River the country is covered with a short thin sod. Many of the extreme western plants are here first met with. This country ends at the Sweet Grass Mountains or Les Trois Buttes, which lie about 20 miles apart, and rise nearly 2,000 feet above the level of the plains, or about 6,500 feet above the sea. From the Buttes to St. Mary's River the country improves in appearance and shows evidence of greater rainfall. On crossing the St. Mary's River the country becomes undulating, and is covered with a thick vegetable soil, supporting a luxuriant growth of grass, and timber in

all stages of development. In addition to giving the names of the various plants seen in the different localities, the author described in detail a few of the more beautiful or peculiar ones, viz., Anemone patens, L. var. Nuttalliana, Gr.; Geranium incisum, Nutt.; Œnothera cæspitosa, Nutt; Opuntia Missouriensis D C.; Mamillaria vivipara, Haw.; Sarcobatus vermiculatus, Torr.; and Elæagnus argentea, Pursh.

ON THE INCEPTION OF THE YOUNG OF MARSUPIALS.

BY J. ALSTON MOFFAT, ESQ.

(A Paper read before the Biological Section, May 4th, 1888.)

It was stated that the young are born in a very imperfect condition and small in size, special arrangements being required to secure their existence. When born they are transferred by the mother to a pouch, within which are contained the nipples. For some time the young are nourished involuntarily. Later they can suckle by their own exertions. This statement of the case was contrasted with that of an Australian kangaroo hunter, whose curiosity had been excited in the subject and who took every opportunity to investigate it. He had killed a large number of kangaroos at all seasons of the year. He examined the females carefully inside and out, and he asserted most positively that in no solitary instance did he ever find the slightest symptoms of young inside. On the other hand, he found them in all stages of development attached to the nipple, and so completely a part of the mother that it was impossible to separate them without the use of a knife. Does it then seem probable that a creature so immature—about an inch long, and the color and consistency of an earth-worm, and consequently so helpless—could be made to adhere to the nipple until it grew fast, as described by the hunter? The nipple passes far down the throat of the young, the breathing tubes being quite independent and not interfered with. A peculiar set of muscles in the mother forces a constant supply of nourishment to the young without any exertion on their part while it remains attached. So the conclusion arrived at was, that the young are at the nipple from the beginning of their existence—that they grow, develop, and mature there, and having arrived at a certain stage of maturity, they drop off like a ripe fruit from its supporting stem.

ARBOREAL HABITS OF SOME OF OUR NATIVE SNAKES.

BY J. ALSTON MOFFAT.

(A Paper read before the Biological Section.)

It was remarked that few believed that any of our snakes could climb trees. Mr. Moffat had seen a garter snake moving upward in the corrugations of the bark of a large pine tree, fully five feet from the ground. It was also stated that a pale green snake had fallen from a branch nine feet high, which had been struck by a stick in looking for entomological specimens. It was no uncommon thing to find this kind in trees and bushes. At Long Point, Lake Erie, he had often seen garter snakes on scrub oak five feet from the ground. One he specially noticed was out on the end of a horizontal branch, where it was not one-fourth the thickness of the snake, which, when disturbed, glided off and dropped to the ground as if it was its regular habit. A case was also mentioned of a snake of the largest kind found at Long Point being shot in the top of a maple tree a foot in diameter, with a clear stem 25 feet high, and standing alone.

PLANT COLOR.

ABSTRACT OF PAPER BY A. ALEXANDER.

(Read before the Biological Section, 20th January, 1888.)

More or less intense color always accompanies the various degrees of imperfect vegetation. Spring and autumn tints come under the same explanation as flower colors, in that there is in each case a using up of previously obtained material, not a predominance of the constructive elements throughout the cells. Reference was made to what may be seen among the cryptogams, viz.: the coloring in connection with reproduction, where the unproductive parts of many mosses are yellow or white, their energy being spent otherwise than in producing chlorophyll. Spencer and Grant Allan were quoted as pointing out that "incipient floral color is present in all imperfectly developed shoots," or "might be expected to appear in flowers because of their low constructive energy." Evidence of this may be seen in the Caulerpa, where it is often yellow when in a

comparatively dry or less nutritive habitat, but becomes green when grown in water, to it, a more nutritive condition. The crotons and other foliage plants, so called, or such plants as Arum Maculatum, have their colors more intense when pot bound, or growing in less nutritive places; while we find that green invariably takes the place of the purple, bright rose, scarlet or white of the leaves when grown under more vegetative conditions, as, for instance, when newly repotted. It was also noted that it is where growth is locally restricted—as, for instance, in the petioles of Primula Sinensis, or on the secreting surfaces of Pitcher plants or Drosera—that color tends to appear. Would not a similar explanation account for the red tips of the daisy and other flowers? or for the appearance of new colors at the apex of the petals, as it is in the apex rather than the base or among the disc flowers that growth has most certainly ceased. And may we not similarly account for the predominant white color of winter flowers, because at that time of year all growth is sluggish, and there is less actively destructive change from the primary yellow color. Those who have climbed *alpine heights* for botanic treasures must have noticed that alpine flowers, growing where there is an open and sunny exposure, favoring high destructive change, are notably brilliant. And as the insect is made to figure so largely in what is called the "new biology," in relation to plants and natural selection, it was remarked that this color cannot be said to result because there are more insects in alpine regions than in lowland; nor is the explanation of white rather than red winter flowers to be found in the absence of insects which would select red at that time, as has been suggested. Changes in color during the life of the flower, as seen in say Convolvulus minor or Myosotis versicolor, are but graduations of the natural series of changes observed with greater or less distinctness in nearly all flowers. Such changes occur especially just before death. They are very noticeably caused by altered climatic conditions, as, for instance, where a cold and damp winter has been observed to be productive of white varieties, or a hot, dry summer of red ones. That white varieties of plants, normally red or blue, are products of changed or weakened constitutions is shown in the fact that such plants as white erica may be distinguished while still in the seed-pan, and long before there is any sign of blooming. In relation to the part borne by insects in this connection, it was stated as a very suggestive and striking fact that hues the most

brilliant should exist always unseen in the very structure of the living plant, ready to be developed at any time by proper selective or accidental circumstances. Some of the colors may be produced by the oxidation of the green chlorophyll in person; others are actually present in the green leaf itself, though completely masked during the period of vigor by the preponderance of the natural pigment, which owes its color to a due mixture of them all. When it is considered, however, that colors like these lie ready and waiting in the tissues of every plant, showing themselves wherever the chlorophyll is not present in its most active form, alike in the young leaves or sprouting shoots of spring, and in the dying foliage of autumn, it is, I suppose, somewhat easier to understand how the beautiful and brilliant petals of flowers have been developed by the selective action of insects. The red and orange and blue pigments were potentially there already; the insect's part was only to seize upon and favor them whenever special circumstances happened to bring them out.

JOURNAL AND PROCEEDINGS

—OF THE—

Hamilton · Association

FOR SESSION 1888-9.

PART V.

CONTENTS.

AUTHORS OF PAPERS ARE ALONE RESPONSIBLE FOR THE STATEMENTS MADE AND THE OPINIONS EXPRESSED THEREIN.

PRINTED FOR THE HAMILTON ASSOCIATION BY THE TIMES PRINTING COMPANY.

1889.

JOURNAL AND PROCEEDINGS

—OF THE—

Hamilton Association

FOR SESSION 1888-9.

PART V.

AUTHORS OF PAPERS ARE ALONE RESPONSIBLE FOR THE STATEMENTS MADE AND THE OPINIONS EXPRESSED THEREIN.

PRINTED FOR THE HAMILTON ASSOCIATION BY THE
TIMES PRINTING COMPANY.

1889.

OFFICERS FOR 1888–9.

President.

REV. SAMUEL LYLE, B. D.

Vice-Presidents.

T. J. W. BURGESS, M. B., F. R. S. C. W. A. CHILD, M. A.

Secretaries.

H. B. WITTON, B. A. A. ALEXANDER, F. S. Sc., Lon. Eng.

Treasurer.

RICHARD BULL.

Curator and Librarian.

ALEXANDER GAVILLER.

Council.

J. ALSTON MOFFAT. T. W. REYNOLDS, M. D. S. J. IRELAND.
B. E. CHARLTON. WILLIAM KENNEDY.

Museum and Library.

ARCADE BUILDING, James St. North, Hamilton, Ontario.

NOTICE.

THE HAMILTON ASSOCIATION was instituted on 2nd November, 1857, and continued its regular meetings to the close of the year 1860. During the period between 1861 and 1871, the meetings were held at irregular intervals, the office bearers of 1860 holding office in the meantime. During the years 1871, 2, 3, 4, and 5, the Association was more active in its work, regular meetings being held. An interregnum of four years ensued from 1875 to 1880, during which time the Council met at stated intervals. From 1880 to the present time the Association has been in active operation, during which period, in addition to the regular monthly meetings, special meetings have been held under the direction of the Council, the Annual Meeting held in May, 1889, being the one hundred and fifty-sixth meeting of the Association.

The Association was incorporated in 1883.

OFFICE-BEARERS.

	President.	1st Vice-Pres.	2nd Vice-Pres.	Cor. Sec.	Rec. Sec.	Treas.	Libr. and Cur.
1857	Rev. W. Ormiston, D. D.	John Rae, M. D., F. R. G. S.	J. B. Hurlburt, M.A., L.L.D.	T. C. Keefer, C. E.	Dr. Craigie....	W. H. Park...	A. Harvey.
1858	John Rae, M. D., F. R. G. S.	Rev. W. Ormiston, D. D.	J. B. Hurlburt, M.A., L.L.D.	T. C. Keefer, C. E.	Dr. Craigie....	W. H. Park...	A. Harvey.
1859	Rev. W. Ormiston, D. D.	J. B. Hurlburt, M.A., L.L.D.	Chas. Robb........	T. C. Keefer, C. E.	Dr Craigie....	W. H. Park...	A. Harvey.
1860	Rev. W. Inglis, D.D.	T. McIlwraith.....	Rev. W. Ormiston, D. D.	Dr. Craigie....	Wm. Craigie...	W. H. Park...	Chas. Robb.
1861	Rev. W. Ormiston, D. D.	J. B. Hurlburt, M.A., L.L.D.	Rev. W. Inglis, D.D.	Dr. Craigie....	Wm. Craigie...	W. H. Park...	T. McIlwraith.
1871	W. Proudfoot.	Judge Logie.......	R. Bull...........	J. M. Buchan, M. A.	I. B. McQuesten, M. A.	W. G. Crawford	T. McIlwraith.
1872	Judge Logie.......	H. B. Witton, M.P.	R. Bull...........	J. M. Buchan, M. A.	I. B. McQuesten, M. A.	W. G. Crawford	T. McIlwraith.
1873	H. B. Witton, M. P.	J. M. Buchan, M.A.	A. T. Freed.......	Geo. Dickson, M. A.	Geo. Dickson, M. A.	R. Bull.......	T. McIlwraith.
1874	H. B. Witton, M. P.	J. M. Buchan, M.A.	A. T. Freed.......	Geo. Dickson, M. A.	Geo. Dickson, M. A.	R. Bull... ...	T. McIlwraith.
1875	H. B. Witton......	J. M. Buchan, M.A.	W. H. Mills.......	Geo. Dickson, M. A.	Geo. Dickson, M. A.	A. Macallum, M. A.	T. McIlwraith.
1880	T. McIlwraith.....	Rev. W. P. Wright, M. A.	H. B. Witton......	R. B. Hare, Ph. D.	Geo. Dickson, M. A.	R. Bull.......	A. T. Freed.
1881	J. D. Macdonald, M. D.	R. B. Hare, Ph. D.	B. E. Charlton.....	Geo. Dickson, M. A.	A. Robinson, M. D.	R. Bull.......	W. H. Ballard, M. A.
1882	J. D. Macdonald, M. D.	B. E. Charlton.....	J. A. Mullin, M. D.	Geo. Dickson, M. A.	Wm. Kennedy.	R. Bull.......	W. H. Ballard, M. A.

1883	J. D. Macdonald, M. D.	B. E. Charlton.....	H. B. Witton......	Geo. Dickson, M. A.	Wm. Kennedy.	R. Bull.......	W. H. Ballard, M. A.
1884	J. D. Macdonald, M. D.	H. B. Witton......	Rev. C. H. Mockridge, M.A., D.D.	Geo. Dickson, M. A.	A. Alexander..	R. Bull.......	Wm. Turnbull.
1885	Rev. C. H. Mockridge, M.A., D.D.	Rev. S. Lyle......	W. Kennedy......	Geo. Dickson, M. A.	A. Alexander..	R. Bull.......	A. Gaviller.
1886	Rev. C. H. Mockridge, M.A., D.D.	Rev. S Lyle......	Matthew Leggat...	Geo. Dickson, M. A.	A. Alexander, F. S. Sc.	R. Bull.......	A. Gaviller.
1887	Rev. S. Lyle, B.D..	B. E. Charlton.....	W. A. Child, M. A.	H. B. Witton, B. A.	A. Alexander, F. S. Sc.	R. Bull.......	A. Gaviller.
1888	Rev. S. Lyle, B.D..	T. J. W. Burgess, M.B., F.R.S.C.	W. A. Child, M. A.	H. B. Witton, B. A.	A. Alexander, F. S. Sc.	R. Bull.......	A. Gaviller.
1889	B. E. Charlton.....	T. J. W. Burgess, M.B., F.R.S.C.	J. Alston Moffat...	H. B. Witton, B. A.	A. Alexander, F. S. Sc.	R. Bull.......	A. Gaviller.

LIST OF

Corresponding, Honorary, & Life Members

—OF THE—

HAMILTON ASSOCIATION.

ELECTED.	CORRESPONDING MEMBERS.
1881	Clark, Chas. K., M. D., Rockwood Asylum, Kingston, Ont.
1881	Van Wagner, P. S., J. P., Stoney Creek, Ont.
1884	Bull, Rev. George A., M. A., Niagara Falls, S., Ont.
1882	Lawson, A. C., M. A., Geological Survey of Canada, Ottawa, Ont.
1881	Spencer, J. W., Ba. Sc., Ph. D., F. G. S., Columbia, Mo., U. S.
1870	Wright, Prof. W. P., M. A., Santa Barbara, California.
1871	Seath, John, M. A., High School Inspector, St. Catharines. Ont.
1885	Frood, T., Sunbury, Ont.
1889	Yates, William, Hatchley, Ont.

HONORARY MEMBERS.

Grant, Lt-Col., Bay St. South, Hamilton, Ont.
Macoun, John, M. A., Government Botanist and Naturalist, Geological Survey of Canada, Ottawa, Ont.
Dawson, Sir J. William, F. R. S., F. G. S., F. R. S. C., Principal McGill College, Montreal, Que.
Fleming, Sanford, C. E., C. M. G., Ottawa, Ont.
Wilson, Sir D., L.L. D., Principal, University of Toronto, Ont.
Farmer, William, C. E., New York, U. S.
Ormiston, Rev. Wm., D. D., New York, U. S.
Rae, John, M.D., F.R.G.S., L.R.C.S., L.L.D., London, Eng.
Hurlburt, J. B., M. A., L.L. D., Ottawa, Ont.
Small, H. B., Ottawa, Ont.
Charlton, Mrs. B. E., Hamilton, Ont.
Keefer, Thomas C., C. E., Ottawa, Ont.
Symons, S., Hamilton, Ont.

LIFE MEMBERS.

Proudfoot, Hon. Wm., Q. C., Vice-Chancellor, Toronto, Ont.

MEMBERS OF COUNCIL.

1857—Judge Logie; Geo. Lowe Reid, C. E.; A. Baird; C. Freeland.

1858—Judge Logie; C. Freeland; Rev. W. Inglis, D. D.; Adam Brown; C. Robb.

1859—Rev. D. Inglis, D. D.; Adam Brown; Judge Logie; C. Freeland; R. Bull.

1860—J. B. Hurlburt, M.A., L.L.D; C. Freeland; Judge Logie; R. Bull; Wm. Boultbee; Dr. Laing.

1871—Geo. Lowe Reid, C. E.; Rev. W. P. Wright, M. A.; A. Macallum, M. A.; A. Strange, M. D.; Rev. A. B. Simpson.

1872—Judge Proudfoot; Rev. W. P. Wright, M. A.; John Seath, M. A.; H. D. Cameron; A. T. Freed.

1873—Judge Logie; T. McIlwraith; Rev. W. P. Wright, M. A.; A. Alexander; I. B. McQuesten, M. A.

1874—Judge Logie; T. McIlwraith; Rev. W. P. Wright, M. A.; A. Alexander; I. B. McQuesten, M. A.

1875—Judge Logie; T. McIlwraith; Rev. W. P. Wright, M. A.; A. Alexander; I. B. McQuesten, M. A.

1880—M. Leggatt; I. B. McQuesten, M. A.; A. Alexander; Rev. A. Burns, M. A., L.L.D., D. D.

1881—T. McIlwraith; H. B. Witton; A. T. Freed; Rev. W. P. Wright, M. A.; A. F. Forbes.

1882—T. McIlwraith; H. B. Witton; A. T. Freed; A. F. Forbes; Rev. C. H. Mockridge, M. A., D. D.

1883—A. Alexander; A. Gaviller; A. F. Forbes; T. McIlwraith; R. Hinchcliffe.

1884—A. Gaviller; A. F. Forbes; T McIlwraith; R. Hinchcliffe; W. A. Robinson.

1885—W. A. Robinson; S. Briggs; G. M. Barton; J. Alston Moffat; A. F. Forbes.

1886—J. Alston Moffat; Samuel Slater; Wm. Milne; James Leslie, M. D.; C. S. Chittenden.

1887—J. Alston Moffat; James Leslie, M. D.; P. L. Scriven; Wm. Milne; C. S. Chittenden.

1888—J. Alston Moffat; B. E. Charlton; T. W. Reynolds, M.D.; S. J. Ireland; Wm. Kennedy.

1889—T. W. Reynolds, M. D; S. J. Ireland; William Turnbull; A. W. Hanham; Lt.-Col. Grant.

ABSTRACT OF MINUTES

OF THE

HAMILTON ASSOCIATION

SESSION 1888—89.

FIRST MEETING—Thursday, 8th November, 1888.

The President, the Rev. Samuel Lyle, B. D., in the chair.

The minutes of the previous meeting were read and confirmed.

The Corresponding Secretary reported the receipt of a large number of exchanges during the recess, and also read letters—the gift of Mr. J. B. Smith—from Bishop Strachan, Dr. Draper, and Charles Merival.

The Curator reported a gift of old engravings from Mr. T. C. Mewburn, through Mr. Alexander, the Secretary; of a very old book entitled "A Supplement to the Lives of the Cæsars," and a volume of "Monumental Effigies in the Temple Church, London," from Mr. Richard Haigh.

A cordial vote of thanks was passed to these donors.

Mr. John Cape was proposed as a member of the Association on the recommendation of Mr. Bull and the Secretary.

The Secretary reported what had been done during the recess, especially referring to the Field-day held at Beamsville on the 30th of June, and calling attention to the kindness of Mr. Wm. Gibson, of that place, who gave us the invitation and contributed so much to the pleasure of the day, by his thoughtful kindness in conveying us to and from his extensive Quarries, where we spent the most of the

day. In the absence of Dr. Reynolds he also gave a brief report of what had been done in the Biological Section during the summer.

The President then read the Opening Address of the Session, his subject being "The Hittites." The history of this remarkable but little known nation, was sketched, and their great power shown from the fact that for centuries they maintained their position and independence though situated between two such strong empires as those of Egypt and Assyria.

Several members spoke on the subject at the close, bearing testimony to the great amount of research aud knowledge displayed in the treatment of this most interesting theme.

It was suggested that our Association should take the publications of the Palestine Exploration Fund. It was so agreed.

The meeting then adjourned, to meet on the second Thursday of December.

SECOND MEETING—Thursday, 13th December, 1888.

The President, the Rev. Samuel Lyle, B. D., in the chair.

The minutes of the previous meeting were read and approved.

John Cape, Customs Clerk, was elected a member of the Association.

The Secretary then read a Paper prepared by Mr. William Kennedy on "Notes on Primitive Man." The conclusions arrived at were briefly these :—

Period of his appearance—Miocene Period.

Locality—South-western Asia..

Condition—Low.

Parents—Unknown.

The matter of the Free Library By-law was discussed at some length, and a motion was unanimously carried, pledging the members present to do their utmost to promote the passage of the By-law.

The meeting then adjourned.

THIRD MEETING—Thursday, February 14th, 1889.

The President, the Rev. Samuel Lyle, B. D., in the chair.

The minutes of the previous meeting were read and approved.

A letter from the Secretary of the Hamilton Chess Club was read, requesting the use of the Room for one night in the week, and suggesting that the members of the Club become members of the Association, the Club to pay a proportion of the gas. The request of the Club was acceded to, on these conditions, and the following names were proposed for membership, viz :—

W. H. Judd, Guy Judd, Kerwin Martin, P. H. Punshon, F. Maw, Alfred Powis, A. E. Morson, M. Herald, J. E. Lister, R. H Green, H. N. Kittson and Dr. Ryall.

The Corresponding Secretary announced the receipt of several "Blue Books" and Reports and Proceedings of several learned Societies.

The Rev. Dr. Mockridge then read the second part of his "Notes on the Waverley Novels." These notes were arranged chronologically as in the first part. The second part of the notes commenced with "Woodstock" and ended with "St. Ronan's Well," comprehending twelve books. The principal characters of each book were passed in review, and the plan and purpose of each work set forth, shewing much careful study.

At the close many members expressed their high appreciation of the manner in which the subject had been presented.

The meeting then adjourned.

FOURTH MEETING—Thursday, 14th March, 1889.

In the absence of the President Mr. B. E. Charlton presided.

The minutes of the previous meeting were read and approved.

The members of the Chess Club, who were proposed for membership in the Association at the last meeting, were unanimously elected.

Mr. Wm. Yates, of Hatchley, who has contributed so many valuable and interesting letters on Biological subjects to the Section, was proposed as a Corresponding Member.

Specimens of copper, an Indian epaulette, and several geologi-

cal and other specimens and curiosities were reported from Mr. T. C. Mewburn, Inspector of Customs ports; also, a kangaroo from Mr. Samuel Briggs.

The thanks of the Association were passed to these gentlemen for their gifts.

Since the previous meeting a very handsome President's chair, in rep and carved, with a fine table to match, had been placed on the platform at the upper end of the room.

A very cordial vote of thanks was passed to the gentleman, Mr. Samuel Symons, for his valuable gift.

The request of the Wentworth Pioneers and Historical Society, for the use of the room for a general meeting of the members of that newly formed Society, was granted.

Mr. S. J. Ireland, Principal of the Hamilton Art School, then gave a very instructive lecture on "The History of Pottery and the Ceramic Art."

The history and progress of the art was traced from the earliest times down to the present. The lecture was illustrated by many beautiful specimens of China and fine ware kindly lent for the occasion by Messrs. J. A. Skinner & Co., Mr. A. T. Wood, and others. Mr. Ireland also described the mode of manufacture and decoration of these various examples. The lecture was listened to with great attention.

The meeting then adjourned.

FIFTH MEETING—Thursday, 11th April, 1888.

J. D. Macdonald, M. D., presided in the absence of the President.

The minutes of the previous meeting were read and confirmed.

Mr. William Yates, of Hatchley, was elected a Corresponding Member of the Association.

Commander Cheyne, of H. M. Royal Navy, who was present, was introduced by Mr. Alexander, the Secretary.

Contributions to the Library and Museum were reported by the Curator and Corresponding Secretary.

Mr. H. B. Witton, Sr., then read a very valuable paper on "Selenography." The paper gave a historical sketch of the re-

searches into the nature of the moon's surface and the various theories that have been held in regard to it, and its present condition and appearance. He also minutely described the mountains, craters, plains, crevasses and other physical features of the surface of the planet, all of which were well illustrated by the famous Rutherford photographs, which were exhibited by Mr. Hugh C. Baker.

The paper was an excellent one, showing a very intimate knowledge of the subject. The attendance at this meeting was the largest present at any meeting of the Association for many years, the room being crowded to the door. Nasmith's splendid photographs of the moon's surface were also on view, through the kindness of Commander Cheyne.

The meeting then adjourned.

SIXTH MEETING—Thursday, 9th May, 1889.

The Rev. Samuel Lyle, B. D., presided.

The minutes of the previous meeting were read and confirmed.

Mr. S. Symonds was elected an honorary member.

Colonel Grant then read two papers entitled "The Colored Lingulæ of the Silurian Rocks" and "The origin of Chert (flint) in the Niagara Rocks near Hamilton." These papers exhibited the writer's intimate knowledge of these subjects. They were well received, and will appear in the Transactions of the Association.

At the close of reading Colonel Grant's papers, and the complimentary remarks made thereon, Mr. Witton, Sr., moved that the general meeting do now adjourn in honor of the memory of Mr. C. S. Chittenden, a member of the Association and Chairman of the Biological Section, who died suddenly on the previous day. Mr. Witton, who had known the deceased gentleman for thirty years, paid a beautiful but deserved eulogy to his character and abilities.

The Secretary was instructed to convey the expression of sympathy of the members to Mrs. Chittenden and the family.

The annual meeting of the Association was then held, the President in the chair.

The minutes of the previous annual meeting were read; they had previously been confirmed. The Secretary, Mr. Alexander, read his Annual Report of the operations of the Association. Dr.

Reynolds read the Annual Report of the Biological Section, and Mr. Richard Bull, Treasurer, read the Financial Statement. All these Reports were received and adopted, and will be found at the end of this volume of the Association's Proceedings.

The election of officers for the ensuing year, 1889-90, was then proceeded with, resulting as follows :—

President, B. E. Charlton.

1st Vice-President, T. J. W. Burgess, M. B., F. R. S. C.

2nd Vice-President, J. Alston Moffat.

Corresponding Secretary, Henry B. Witton, B. A.

Recording Secretary, A. Alexander, F. S. Sc., London, Eng.

Treasurer, Richard Bull.

Curator and Librarian, Alexander Gaviller.

Council—T. W. Reynolds, M. D., Colonel Grant, S. J. Ireland, Principal of the Art School ; William Turnbull, A. W. Hanham.

After votes of thanks to the retiring officers the meeting then adjourned.

A. ALEXANDER,
Secretary.

SAMUEL LYLE,
President.

HAMILTON ASSOCIATION.

SESSION 1888-89

IS SPECIES A NATURAL OR ARTIFICIAL DIVISION IN NATURE?

A Paper read before the Biological Section, December 7th, 1888,

BY J. ALSTON MOFFAT,

(Member of the Council of the Entomological Society of Ontario.)

Is Species a natural or an artificial division in Nature? This is a question that will bear a good deal of discussion; for, although volumes upon volumes have been written about the origin of Species—what a Species is, and the correct use and application of the term has been left in the most nebulous condition imaginable, whilst, for practical value, this is of ten-fold more importance than the other, and ought to have been definitely settled before ever the other was discussed.

Violent controversies have been and are being carried on about Species with no profitable result, because the combatants are using the same term whilst meaning quite different things.

Wearied with the confusion, I found it necessary, for my own comfort, to settle the question to my own satisfaction at least. So I herewith give you my conclusions, and my reasons for them.

We are often reminded that we should take Science exclusively as our guide in the interpretation of Nature. I most unhesitatingly and unreservedly accept the condition. The question immediately arises, What is Science? As defined by Webster, it is, first, "certain knowledge," and second, "knowledge arranged and systematized." The only thing in which all men are born absolutely equal, is in the matter of knowledge—that is, in the utter absence of all knowledge. Time, opportunity and capacity is required for the obtaining of knowledge—by our own observation and experience,

or by the observation and experience of others communicated to us, which, when perfectly reliable, should be accepted by us and be as useful to us as our own. The observations and experience of several persons, agreeing on some particular thing, is confirmatory; this, continued for generations, becomes absolute certainty. It is thus that we have attained to our knowledge of the laws of Nature, on whose stability we confidently rely. Long continued observation and experience having demonstrated that, given a certain condition and combination, a certain result will follow, and that that condition and combination will inevitably produce that result every time; change the condition or the combination, and a change in the result will assuredly follow. This we call a law of Nature, and it is the absolute stability of these that has made Science possible.

The next question is, what is Nature? I reply, all matter and life that we can investigate in time and space. Anything beyond this must belong to the supernatural, of which, by no natural powers in our possession, can we discover anything. We may draw inferences about it from what we know, but these will be always open to question; or, we may believe what we have been told about it, but there our knowledge on the whole subject ends, and our belief in the statement will be in exact proportion to our confidence in the source from which it came.

The term "Species," or its equivalent, is no doubt an ancient one, and would be in use long before classification was thought of.

When man at first began to observe the forms of life around him, he saw them separated into a great many different kinds. These kinds did not commingle and lose their identity. Each came from ancestors of its own kind, and its progeny was in its own likeness. This he concluded had been going on since their origin, and would go on to the end of their history. These kinds he called "Species," and associated with it the idea of permanence. Common names were early given by men to the common forms of their country, but it was discovered that different names had been given to the same form in different parts of the same country; so, to avoid confusion, it became necessary to describe the form and give it a name that would distinguish it in that and all other countries. As investigation became more general, and the students of one country travelled into others, their attention was arrested by the fact that some of the familiar forms had changed their appearance, and as he

progressed this became yet more apparent, until at length the description of one would not apply to the other, and it began to be suspected that the old idea of permanence was incorrect, and would have to be abandoned.

Different conditions had produced different results.

Systematic classification is the progressive work of time.

Our present system of Nature is but of recent origin; that it is not perfect is but to say that it is human in its origin. Still, it is an improvement on the past; it grasps all Nature, and divides it into the celestial and terrestrial. In the terrestrial it finds the organic and inorganic; of the organic it has constituted two kingdoms, the animal and the vegetable, [and here let me remark that I am going to deal exclusively with the animal kingdom]; this it has separated into sub-kingdoms, classes, orders, families, genera and species.

Now these divisions which it is so necessary for man to make, that he may the better understand and study his subject, has no clear dividing lines in Nature. There is an elasticity and a blending of parts in Nature, that, from the limited character of man's intellectual grasp, and the barrenness of his language to express what he may intellectually perceive, no human system has ever yet attained to. We know, as a matter of fact, that this Ball, which we call terrestrial, is as much a part of the celestial as any of those we term such; that the organic is depending on, and inseparably connected with the inorganic. Who can say where the vegetable ends and the animal begins? And just so it is through the whole list; it is at the point of divergence and not that of contact that any of them is clear.

It is upon structure that the divisions in the animal kingdom are principally founded—size, form and color. By a single bone may the class to which the animal belongs be known; by certain resemblances its family relationship is established; upon some points of difference, peculiar to it, its genus is found, and by minuter ones is its specific character determined.

It is now a well known fact that there are opposing influences at work in nature affecting the appearance of every living creature; the one tending to uniformity and the other to diversity. Prof. Huxley says: "The one end to which, in all living beings the formative impulse is tending, seems to be to mould the offspring into the likeness of the parent."

Prof. Louis Agassiz, after premising that all animals, even the

highest—men not excepted—are produced through eggs, says: "It is a marvellous process, that of the inner life of the yolk, leading to a result so extraordinary as the formation of a new living being. Here is something wonderful; not only the simplicity of the process by which the change is brought about, but still more marvellous is the fact that all this goes on from within. There is a principle acting by the aid of the substance which holds it, never deviating from its course, and always leading to the production of a being like the parent."

Now it is clear that if this principle or law of nature was always acting unopposed, there would be no difficulty in deciding (by structure) to what Species any form belonged, for there would be little or no diversity in a Species. But this, we know, is not the case. Herbert Spencer says: "Every Species spreading into a new habit, at coming in contact with new food, exposed to a different temperature, to a dryer or moister air, to a more irregular surface, to a new soil, etc., has its members, one and all, subject to various changed actions, which influence its muscular, vascular, respiratory, digestive and other organs." Now this is simply a clear and comprehensive statement of a fact, which we may see with our own eyes, but we must remember in connection with it, that all animals are not equally sensitive to these influences; some may show it, little, if at all, whilst in others it will be quite perceptible; and again, that the migrant or its descendants will attain to the maximum of change which that locality is capable of producing, and never any more. That a further migration is needed to produce more change, that these changes will invariably be in the same direction in the same kind of animal, that migrants going in opposite directions on the globe will come in contact with different influences that will produce different results in the same kind of creature; and that these influences under which it is living are performing their work and bringing it into harmony with its surroundings, wholly independent of the creature's will or inclinations. Of these operations the animal may be utterly unconscious, and even if it were conscious it would be as utterly unable to resist them.

Now all the living creatures of the present are, more or less, given to migrating, according as they can accommodate themselves to altered conditions in soil, climate and food, and the ancestors of these did the same ever since they were first originated. What

an immense diversity of influences then must some of them have been in contact with during their continuance in time and space, and, if sensitive to these, what a diversity in size, form and color is to be expected as a result. This helps to account for much of the marvellous diversity which we actually do find in nature everywhere around us.

It is specially desirable to note here, that these influences we have been considering, which accomplish the change in organisms, are wholly external, acting from without, just as we saw that those which make uniformity were internal, acting wholly from within.

But there are several other influences at work in Nature producing variety in organisms, some of which we as yet know little or nothing about, hence the expression, "accidental variation." But as accident is not recognized in science, every effect having unquestionably an efficient cause, whether within the range of our ken or no, I prefer "individual variation" to express the idea associated with these peculiarities that unexpectedly show themselves, and which are often seized upon by breeders for the improvement of stock, and for the production of fancy and ornamental forms. This has been carried to an astonishing length in some departments, and these varieties may appear in Nature as well.

Here then the question arises, do these variations, by whatever cause produced, or by whatever name called, going off in opposite directions, ever attain a point of complete separation: that is, when individuals that have come from a common stock are brought together from the extremes of unlike, will Nature in them fail to acknowledge their original relationship. Consideration is required here. We know that many animals go in flocks, herds, coveys, swarms, &c., and that each of these aggregations incline to keep by themselves, and do not readily mingle in Nature; that an individual from one of these will be refused admission into another of the same kind, and can only obtain it by conquering a position. This we see frequently amongst domestic animals, and if the external forms are diverse the trouble is all the greater, so that it may require time, restraint, compulsion even, to get them at first to live together. This being accomplished, all our information goes to prove that no matter what external difference separates them, internally they are yet one. Mr. Tegetmeyer, the celebrated writer on poultry, when describing how he had bred the golden, the silver and

the common English pheasants together, said:—"Aftèr this the "reader will be ready to inquire, what constitutes a Species? All "that I can do is to echo the question, what constitutes a Species?" He had contemplated his birds and marked their great and striking dissimilarity, and concluded that they must be separate Species; he turned to his books, and the authorities pronounced them separate Species; he brought them together and they commingled freely, nature in them asserting they were not separate Species, they were but distinct varieties of one Species. Illustrations might be multiplied indefinitely, but one is sufficient to point the direction.

Another inquiry we have to make is: If separation for a sufficient length of time will completely extinguish all evidence of original relationship? There is the so called genus Bos. How long have the humped cattle of the East been separated from the bison of the West? Is it a thousand years, or five, ten, twenty or a hundred thousand, who can say? But bring them together, from any distance or in any of the multitudinous forms of which the genus is composed, and they commingle freely. Their distinctive peculiarities merge and blend until finally lost, proving them to be not Species of a genus, but varieties of a species, and that time and distance have failed to extinguish their original relationship.

The possibility is that at one time in the world's history, all these various forms of a Species of the present, were represented on the earth by a single form--and that form may have been quite unlike anything of the present—and if it lived under entirely different conditions it undoubtedly would be. But whether the Species originated in single ones or pairs, in a single locality, and spread from there over the globe, or came into existence singly or in pairs, in various localities, or in groups, or in multitudes, is not now possible to prove, and does not seem to be of any consequence. For if they were one in Nature, and identical in internal organization, the result would be the same. If then no amount of divergence in size, form and color, and no length of separation in time, places any obstacle in the way of the ordinary laws of generation, we have got a clear, definite, dividing line for Species, and one that proves Species to be a real and natural entity, quite different from Structure. For seeing that all life of the present, as well as that of the past, is, and has ever been, surrounded by, and in constant contact with, those influences that tend to produce change in Structure,

according to its susceptibility to receive the impression, we have no right to look in that direction for dividing lines between Species, and the torture of conflicting uncertainty endured by conscientious men, in their efforts to arrive at a correct conclusion by that method about various forms. Whether they are Species or Varieties, and which is the Species and which is the Variety, and where the line is to be drawn between them, is really deplorable, and is well voiced in the vigorous language of Darwin, when he says:—"After describing a set of forms as "distinct Species, tearing up my manuscript and making them one "Species, tearing that up and making them separate, and then "making them one again—as has often occurred to me—I have "gnashed my teeth, cursed Species, and asked what sin I had com-"mitted to be so punished?" And thus it is made abundantly manifest, that determination by structure is not necessarily a determination of Species at all, but only the defining of the differences between various forms, which may be improperly called Species; and that all this misery and conflict that is endured by Species-makers is quite uncalled for and unnecessary, for the differences are there, visible to the eye, and are easily described. The trouble comes in when the effort is made to decide just how much difference should be considered enough to make a Species, which is merely a matter of individual opinion, and of which there is an abundant diversity; and so it appears perfectly plain to me that the contention which has been going on for so many years under the head of the origin of Species is a misnomer; it is the origin of varieties that has been brought to view, and the ages yet to come will have ever to acknowledge their indebtedness to Darwin for the vast stores of facts which he has accumulated for their use on this subject.

In the *American Naturalist* for April, 1888, is an article by Mr. Chas. Morris, entitled "Intelligent Selection," in which he contends that man may have produced, in that way, as true Species as nature does by natural selection, and says "that Species have not "been produced by man is more an assertion than a demonstrated "fact," then claims that certain forms of pigeons and dogs might be "regarded as of specific value, or even generic, and says "if we take "the varieties of the dog, such wide differances in size, form and "habit, if found in Nature, would be at once accepted as well "defined Species." A perfectly true statement I believe, but one

that does not prove his contention; but I think it does prove most conclusively the extreme probability there is that we have in our catalogues an abundance of so called Species, that are not one whit better Species in Nature than those varieties of the dog.

So I conclude;—that Species is a natural division in Nature, and absolutely permanent in the line of descent.

That fertile progeny is an unmistakable evidence of oneness of Species.

That a Species is not necessarily one in size, form and color. True, it may be an individual form that has maintained its appearance, from its first origin to the present, unchanged, but that it is far more likely to be a great number of various forms that have been moulded, modified and diversified, in a thousand ways since its first origin, and no one of these various forms is entitled to claim the term to the exclusion of any one of the others, for each and all of them are required to complete the Species as it is in Nature.

That determination of Species by structure is artificial, and, from the very nature of things, uncertain. So a Species may generally be regarded as a group of more or less distinct forms, the origin of whose diversity may be involved in obscurity at the present day.

The question of origin belongs to the domain of philosophy rather than that of science, but science has demonstrated that no spontaneous origin of life has been found. Yet there was a time when life did not exist on this globe, so that it must have originated in some way; but life being granted, Species has to be as a matter of course, if life is to be permanent, for every form, no matter how low in the scale of being it may be, is perpetuated by ordinary generation in some way, and each Species perpetuates its own kind only, and never any other. But whether the Species of the present originated by a miracle of creation, and have been modified by the external influences of ages, eras and epochs, until they appear as we see them; or by a progressive succession of miracles of transmutation, until they have arrived at what they are, does not seem to matter much, for miracle it would be in either case, because transmutation is in just as direct violation of the laws of Nature, as we know them, as creation is. But if science can say negatively that Species is not self originating, it can never say positively they originated by miracle, for that belongs to the supernatural, of which science can

discover nothing. The most it can say is that it knows of nothing else that will account for it.

Unquestionably, the conditions and combinations were vastly different in various periods of the world's history, producing greatly different results, but we have not a shadow of a reason for supposing that the laws of Nature were different. It is certain knowledge that constitutes science, not uncertain opinion that has not yet crystallized into knowledge.

We have heard a great deal about "missing links." If the authorities fail to discriminate correctly between Species living and moving before their eyes, what are they likely to do with the crushed remains of extinct forms? If the links were all in their hands would they recognize them? If the skeletons of the widely divergent forms of our dog were found in the rocks they would hardly be taken for the same kind of animal, let alone the same Species.

We have also heard a good deal about the breaking down of barriers between species and species, genus and genus, order and order, kingdom and kingdom. What were these barriers? Artificial ones, erected by man at the limit of his knowledge, which with an increase of that, he found it necessary to remove, as he had put them up in the wrong place; but Nature's one and only barrier, found in the whole breadth of the animal kingdom, stands just where it did before ever man began to investigate it, and as firmly as ever it did, and that is the one between Species, no other having any existence in Nature whatever.

"THE HITTITES."

Read before the Association, November 8th, 1888,

BY REV. SAMUEL LYLE, B. D.

The discovery of the lost Hittite Empire may be regarded as the great historical surprise of the nineteenth century. Awakening from a sleep of two thousand years, the Hittites claim to be recognized as a powerful, learned and warlike people. A few able critics refused, on what seemed good grounds, to admit the claims put forth by the friends of the discovery. Was it likely that a nation, powerful almost as ancient Egypt, could be entirely lost and that no trace of it had appeared for two thousand years, save a doubtful reference or two in the Sacred Books of the Hebrews? How could this be, when the nation in question was linked, and that most closely, to the three ancient, oriental peoples most familiar to us—the Hebrews, the Egyptians, and the Assyrians? If, a priori, ideas could settle the point in dispute, then we would be forced to conclude that no such people as the Hittites ever existed. But, happily, we live in an age that has learned to place a high value on facts, and so to use them as to unlock the mysteries of the past and the present; and, happily too, the love of truth has induced men of great ability to go out to the fields once tilled by races now extinct, and to dig up the relics that have thrown so much light on the history of the Ancient Orient. Through the labors of such men the most startling results have been reached, and we are brought face to face with the long lost Hittites.

Upwards of seventy years ago Burckhardt, in his work on Syria, declared that he had seen in the corner of a house of one of the bazaars a stone with hieroglyphics differing from those of Egypt. Many declared that Burckhardt was mistaken, and that no antiquities existed in Hamah. From the nature of the case the general public took no interest in finding out the truth. This state of mixed incredulity and indifference was brought to an end through the discov-

eries made by two Americans, the Rev. S. Jessup and Mr. J. A. Johnson. Their announcement of the discovery of the Hamah inscriptions awoke a profound interest in the minds of antiquarians, linguists and historians. Soon rude copies of the stones were procured, and given to the world through the medium of the American Palestine Exploration Society. Captain Burton's explanations of the stone, and of its strange writings, deepened the growing interest in the Hamah inscriptions. Dr. Wright and Mr. W. R. Green, working through the Sublime Pasha, at last succeeded in securing these stones, thus opening the way to the discovery of the lost Empire of the Hittites. When the natives found that their treasures were about to be removed, they threatened to destroy them rather than permit them to be taken away. Let me quote Dr. Wright's words:—"I saw "now that a crisis was reached. For hundreds, perhaps thousands "of years these mute inscriptions had waited for some one to hear "their story. Egyptian, Assyrian, Greek, Selucedæ, Roman, Saracen, "Crusader and Turk had passed them by as unworthy of even a "passing notice; and now, that travellers from the Isles of the Sea, "eager to learn their secrets, had arrived, their voice was to be "hushed for ever. A greater calamity than the Moabite stone "tragedy was imminent—a mighty empire was about to claim its "rightful position among the great nations of the ancient world, and "a few fanatics were about to push it back into the outer darkness "to which classic history had assigned it." Happily for the cause of truth, and for the right understanding of the past, the designs of ignorant zeal were frustrated, and the Hamah stones secured.

But what is the import of these inscriptions? By some they were regarded not as writings, but as the vagaries of ornamentation. But the shape of the sharply cut figures, their resemblance to the Cypriote Syllabary, and the discovery of writings similar, have established the fact of their being literature on stone.

This admitted, how are they to be read? Captain Burton thought the key to unlock the inscriptions was to be found in the rude tribe marks of the Bedawi. But the location of the inscriptions belonging to the family of which the Hamah stone are a specimen, the finish of the characters of the writing—a finish clearly indicating good instruments, well used by the skilful hands of ready scribes—are against the supposition that much light to their discipherment is

to be found in "the scratchy tribe marks of the uncultured Bedawin."

Mr. Hyde Clarke thought he could see the clearest traces of resemblance between the Hamah inscriptions and the Himyaritic and Libyan. But Mr. Clarke's theory is at war with the facts of the Hamah writings, both in the matter of time and of space.

Mr. Johnson, the discoverer of the inscriptions, suggested that they might be the work of Assyrians, of Egyptians, or of Hebrews? "We should naturally" he says, "expect to find in the vicinity some trace of the Assyrians and Egyptian conquerors, who ravished the Valley of the Orontes, and of their struggles with the Hittites on this ancient field, and of Solomon, who built stone cities in Hamah. The arrow-headed characters are suggestive of Assur-Nasir-Pal."

Captain Conder, drawing attention to the similarities of the Hittite and the earliest Egyptian hieroglyphics, is inclined to think that they are akin, if not actual representations of early Phœnician. But the ablest and soundest specialists inform us that the Hamah writing is not Hebrew, not Egyptian, not Phœnician, and not Assyrian.

Dr. Wright, Prof. Sayce, Dr. Taylor, and others, regard the Hamah inscriptions, and the others of similar character subsequently found, as Hittite remains. The following extract, taken from Dr. Wright's able work on the Hittites, gives a good idea of the Hittite writings :—

"The Hamah inscribed stones were four in number, and "those contained five inscriptions, one of the large stones being "inscribed on the side and on the end. All the stones were close-"grained basalt (fully ripe, as the Arabs say) doubtless brought "from the basaltic region east of the city. Many similar stones "were lying about or built into the walls, some of them with Greek "and Arabic inscriptions, and some of them having the figures of "animals carved upon them.

"The Hittite inscriptions differ from the inscriptions of Baby-"lon, Egypt, Assyria, Greece and Rome, in that they are all, except "that of Tyana and the Babylon Vase, in raised character. The "lines of inscriptions and their boundaries are clearly defined by "raised bars about four inches apart. The interstices between the "bars and characters have been cut away. The faces of the stones "had been dressed smooth before the inscriptions were carved upon

"them, and the stones, as I have already pointed out, were dressed "narrow towards the inscribed points, their bases being left un- "dressed for several feet. They are clearly intended to be inserted "in masonry with the inscribed parts standing out so that the inscrip- "tions might be publicly read, and these were doubtless in the lan- "guage of the people of Hamah. The inscriptions begin at the top "of the right side, and read along the line between the bars to the "left. The next line is read from left to right, and thus the reader "proceeds from right to left and left to right, *boustrophedon* style, or "as an ox ploughs. The flow of the line is always in the opposite "direction from that in which the speaking figures in the inscriptions "look."

These historic treasures have a tongue, and speak, though the ears of the learned are perplexed as to what they say. Doubtless the key to their understanding is to be found in the thorough mastery of the ancient and mysterious scripts of Asia Minor. In the Hittite Hamah inscriptions we have the central stem of which the Cypriote and Asia Minor scripts are the branches. Speaking of the Hamah treasures, and of others of similar nature, Dr. Taylor says:— "These monuments are those of a people who have been identified "with the Hittites of the Old Testament, the Kheta of the Egyptian "monuments, the Rhatte of Assyrian records, and the *Keteioi* of "Homer (Od. XI. 521). They were one of the most powerful "peoples of the primeval world, their empire extending from the "frontier of Egypt to the shores of the Ægean, and, like the Baby- "lonians and the Egyptians, they possessed a culture, an art, and a "script peculiar to themselves, and plainly of indigenous origin. " * * * It is now admitted that the primitive art, the mythol- "ogy, and the metrical standards of Asia Minor were, to a great "extent, obtained from the Hittites, and the independent system of "picture-writing which they possess, offers an obvious source from "which the Asiatic Syllabary might have been obtained."

Prof. Sayce, who is at work on these Hamah inscriptions, has given a clue to their meaning, and in a short time the historic world will have the satisfaction of knowing what light they throw on the past of a great people long in darkness and in the shadow of death. In the meantime Egypt and Assyria have much to say of the Hittites, and their testimony is confirmed by the witnesses of Jew and of Greek. If the amount of evidence is not so great as we could wish, still

it is ever increasing as the work of the explorer advances, and what is of more importance, the character of the evidence is of the highest order. Three distinct peoples through their literature—a literature written on stone, and secure from the tampering hand of the scribe—tell us of the greatness and glory of the Hittite Empire. And since the literature of stone has risen from the grave of centuries, and told the world of the heroic nations of the dead past, a seemingly meaningless passage in the Eleventh Book of the Odyssey of Homer becomes clear and pregnant with meaning. Mr. Gladstone, who was the first to detect the passage and show its bearings on the Hittites, in a letter to Dr. Wright, says:—"Your "account of the local extension of Hittite influence is in complete "conformity with the idea which conceives them as within the circle "of possible Trojan alliances. I may add to the suggestion, which "I first published in fear and trembling, that the manner of the "mention in Homer is completely in accord with your doctrines as "to the greatness of the Hittites. (1) Because the slaughter of their "chief seems to be the crowning exploit that has been performed by "the son of Achilles. 'I will not,' says Odusseus, 'name all that he "slew, but only the hero Eurupulos.' (2) Because the *Keteioi* are "named without epithet, description, or indication, which accords "with the idea of their being a famous and well known race." Thus we have voices from Egypt, from Assyria, from Palestine, and from Greece, telling us what they know of the Hittites, and all in harmony.

Look at some of the facts brought to light during the last few years. Listen to Egypt's account of her neighbors and rivals in art, in literature, in statesmanship, and war—the Hittites. She is constantly threatened on the north by a people called Amu, which in Egyptian means herdsman. Doubtless the Egyptians used the term to express their contempt for this foe, for we learn from the Good Old Book, that "every shepherd is an abomination unto the Egyptians." Regarding the shepherd's calling as the lowest, the Egyptians would naturally use the word herdsman much in the same way as the Greek spoke of the Barbarian. Among these hordes that were ever hovering around the north of Egypt two nationalities stand out as the most powerful—the Akharru and the Kheta. The Akharru are the Phœnicians, to whom we owe so many elements of our civilization. The Kheta or Khatti are the Hittites, who cross the path of the Bible student as he reads the story of the

Hebrews from the days of the founder of the nation, Abraham, to those of the Captivity. The first Pharaoh who ruled Egypt—the Pharaoh of the twelfth dynasty—destroyed Hittite towns and palaces which were built on the northern frontier of Egypt, and by their destruction crippled the energies of a dangerous rival daring to come so near. If Mariette Bey is right in his conjectures, one of the early Egyptian dynasties was Hittite. May this not explain why Egypt was so sensitive on the subject of Hittite encroachment? May this not in part account for the long succession of wars extending over a period of nearly six hundred years—the war begun by Thothmes I., and continued till the days of Rameses III., who defeated the Hittite invaders in the great "naval engagement near Megdol, at the Pelusiac mouth of the Nile."

When Thothmes III., Egypt's greatest monarch, came to the throne in 1600 B. C., he put forth all his vast powers to crush his north-western rival. But though Thothmes III. made his influence felt to the centre of Africa, where he fought and triumphed; though able to force the borders of India to bow before him; though great in his day as Alexander was centuries later, still he was not powerful enough to crush the Hittites, who stubbornly and successfully resisted him. Indeed, the Hittites had influence with their neighbours, and used it to band together the disjointed peoples, and hurl them in compact form against the might of Egypt. Thus the Hittite king of Kadesh called on the kings, and on their subjects "from the water of Egypt to the river land of Mesopotamia," and they answered his call, obeying "him as their chief." Taking his stand in the strongly fortified city of Megiddo on the Kishon, he awaits the advance of Thothmes, the powerful champion of Egypt. Arriving at Megiddo at midday, the Egyptian monarch instructs his men to hold themselves in readiness for action, to look after their arms, for early on the following morning they must meet the foe. Thothmes, no doubt, chose this time because it was the twenty-fifth anniversary of his coronation. Confident of victory, he would thus link his coronation and Egypt's glory in the web of history. The Hittites, unable to withstand the furious attacks of the Egyptians, reeled, broke their ranks, and fled, leaving their war chariots and their baggage on the field, and taking refuge in Megiddo, as the Russians did in Sebastopol after their defeat on Alma. And as the allies failed in not following up their well fought battle of Alma with the capture of

Sebastopol, thus giving the Russians time to strengthen their position, so the Egyptians, though led by the ablest general of the age, fell into the same fatal blunder, and that through the temptation to plunder the deserted camp, and instead of marching against Megiddo and taking it, gave, by their delay, the Hittites the chance of making their stronghold stronger. This mistake cost Egypt much, and like the mistake of the French and English at Alma, had to be atoned for in suffering and blood. The Egyptian account recognizes the blunder at Megiddo, and in earnest, sensible language, says, "Oh! "that the warriors of the King had not yielded to the desire to "plunder the goods of the enemy, for then had Megiddo been taken "in that same hour." But what might easily have been done, if the tide of Egyptian success had been taken at the flood, became hard a little later, because Megiddo was greatly strengthened, and the might of a thousand cities stood behind its walls to beat back the proud invaders, and to fight for home and all the heart holds dear. But patience, valor and courage never to submit or yield, at last reduced Megiddo, and humbled the Hittites. From the inscriptions we learn that representatives of one hundred and nineteen cities and nations were present in the Hittite camp, assisting them against Egypt; that the Egyptians were greatly enriched by the spoils of war—precious stones, golden dishes, a two handled flagon of Phoenecian work, 925 war chariots, one of which was gold-plated, and belonging to the Hittite King.

This heavy blow stunned but did not crush the Hittite power, and place it under the feet of Egypt. The two Hittite capitals still stood, Carchemish on the Euphrates, and Kadesh on the Orontes. To reduce these Thothmes III. was forced to engage in two long and exhausting campaigns. In the thirty-third year of his reign Thothmes invaded Mesopotamia, and, defeating those opposed to him, brought back spoils from many lands, and tributes from the vanquished. Conspicuous among all was "the tributes of the great land of the Hittites." But the north-western foe still holds out; defeated at one point the Hittites rally their forces at another. "Thus campaign followed campaign, and though the triumphal "records boast in oriental style of Pharoah's victories over the Hitt-"ites, and give long details as to the plunder borne back in triumph "to Egypt, the Hittite resistance was not broken, and succeeding

" years saw new expeditions, and Egyptian armies marching through " the length of Syria against the hereditary foe."

When Thothmes III. died 1566 B. C., the Hittites are still a powerful people, able to force their rivals to respect them. Brugsch says, " Their importance grew from year to year in such " a way, that even the Egyptian inscriptions do not hesitate to " mention the names of the Kings of the Rheta in a conspicuous " manner, and to speak of their gods with reverence." About half a century after Thothmes' death Rameses I. and Saphel, the Hittite King, entered into an agreement to live at peace, and to defend each other from the attacks of outside parties. This treaty led to a breathing time in the long wars waged between Egypt and the Hittites—led the two peoples to respect each others rights and interests.

But the coronation of Seti I. changed the face of Egyptian affairs, renewed the war spirit, and created in the breasts of his subjects the desire for conquest and plunder. Nor was it without cause that Egypt girt on arms and went out to the battle plain; for " the " Bedawin and the Syrians had again begun with impunity to make " incursions over the Egyptian border." Seti I. assembled a large army with numerous chariots, and drove back the invaders from his frontiers, and in his two horse chariot he led his army in pursuit of them as far as the fortress Kanaan, which he stormed. Thence he pursued the retreating foe to Samnia in Phœnicia, where he overthrew, with great slaughter, the kings of the land of Phœnicia. Having humbled the tribes daring to make incursions into Egypt, Seti, without a hint, attacked the Hittites in their stronghold Kadesh, and took it by surprise, while the inhabitants were in the fields engaged in their peaceful pursuits as honest husbandmen. This Seti did as the avenger of broken treaties. It is more than likely that the inhabitants of Kadesh had assisted the enemies of Egypt, and that this was Seti's idea of teaching them a needed lesson. The scene of battle is represented on the north side of the famous temple of Karnak, and in the representation you can see the Hittites, prince and peasant, slain and lying on the ground before Seti and his triumphant hosts.

Rameses II., the son of Seti, figures prominently in history. He is likely the Pharaoh who oppressed the Children of Israel—likely the Sosestris of the ancient Greeks. During his reign the

Hittites mustered all their forces and called to their aid all their allies from the remotest parts of the empire, in order to check the advance of the Egyptians. The scene of conflict was the famous Kadesh on the Orontes—Kadesh inured to the shock of battle. Dr. Wright says: "There were present under the banner of the King of "the Hittites his allies and satraps, from Mesopotamia to Mysia, and "from Arvad in the Sea. Pharaôh set out by the old royal road along "which so many Egyptian armies had marched to the land of the "hereditary enemy. His route lay along the coast of Syria by the "great sea, through Joppa, Tyre, Sidon, and Beyrout. Passing through "the Elenthems Valley, he bronght his army once more before the Hit- "tite city, Kadesh. A great battle was fought, and the special re- "porters of those days have given us full details, in pen and picture "sketches, of all the leading incidents of the fray."

The poet-laureate of Egypt, who accompanied the king, has celebrated the achievements of that day in a heroic poem which has come down to us in several editions. It is found on a papyrus roll, and in conjunction with splendid battle scenes on the walls of temples at Abydos, Luksor, Karnak and Ibsamboul. This oldest extant heroic poem—this first specimen of war correspondence—is too long to quote, but I must give a passage or two. Take his spirited description of Pharaoh:—"King Pharaoh was young and "bold. His arms were strong, his heart courageous. He seized his "weapons, and a hundred thousand sunk before his glance. He "armed his people and his chariots. As he marched towards the "Hittites the whole earth trembled." The enraptured war correspondent describes Pharaoh as deserted, and in his hour of need praying to his Father, the God Amon, who holds out his hand to the great delight of the king. After this Pharaoh is likened to a God hurling darts with his right hand, and at the same time fighting with his left. Making due allowance for the orientalisms, and remembering that the writer is poet-laureate to the King of Egypt, the following has its merits, though not of the highest order. Representing Pharaoh as dashing 2,500 horses to pieces, he says: "That the hearts of the Hittites sank within them. Their limbs "gave way, and they had no courage to thrust the spear. And Pha- "raoh swept them into the Orontes like crocodiles. He slew the "Hittites at his pleasure, and no one resisted him. The King of 'the Hittites sent eight of his brother kings, with armed chariots

"against Pharaoh. With 2,500 horses they rushed on Pharaoh's 'flaming countenance, but he dashed them down and killed them "where they stood. Pharaoh rallied his warriors by his acts of "valour. He cheered his charioteer, almost dead with fear. Six "times he charged the unclean wretches who did not acknowledge "his God. He killed them; none escaped. Then Pharaoh upbraids "his worthless warriers, not one of whom stood by him, and calls "the foreigners to witness that his own right hand had won the "battle." After this the Hittites seek peace, and the Egyptians implore their King to grant it. Pharaoh mercifully grants it, returning to Egypt in the best humour, and resting in his palace like the sun on his throne.

The results of the treaty of peace entered into at this time were all that could be desired. Dynastic alliances sprang out of the state treaties, the most kindly feeling resulted, and love tokens passed between the old rivals and foes. If Mineptah II. is the King of the Exodus, as Brugsch affirms, then he showed a better side to the Hittites than he did to the Israelites, for he sent wheat in ships to preserve the lives of the Hittites. But a hundred years later the old war spirit revives, and Egypt and the Hittites have each other by the throat. Rameses III. in a great naval engagement near Migdol, at the mouth of the Nile, crushed the forces opposed to him, taking the King of the Hittites prisoner.

Dr. Wright thus sums up the story of the Hittites as looked at in the light of their connection with Egypt:—"We see the Hittite "Kings the rivals of the Pharaohs in peace and war from the twelfth to "the twentieth dynasty. The shock of Egyptian invasion exhausted "itself against the frontier cities of Kadesh and Carchemish, but the "mighty empire of the Hittites extended beyond, on the broad "plains and highlands of Asia Minor, and so there were always fresh "Hittite armies, and abundance of Hittite wealth, to enable the "Hittite empire to withstand the might of Egypt for a thousand "years."

Having seen the relation of Egypt to the Hittites, let us now consider the relation of Assyria to the lost Empire.

If the decipherment of the astrological tablets of Sargon of Agane is to be depended on, the Hittites were a powerful nation in the nineteenth century, B. C. Indeed Mr. Pinches, of the British

Museum, places the appearance of the Hittites as early as 3800 B. C. From the inscription of Tiglath-Pileser I. we learn that the Hittites were then threatening Assyria, and that they had to be beaten back through a series of extensive campaigns. In one part of this inscription Tiglath-Pileser I. says that he captured "one hundred and twenty chariots fitted to the yoke," and in another, "there fell into my hands altogether, between the "commencement of my reign and my fifth year, forty-two countries "with their kings, from beyond the river Zab to beyond "the river Euphrates, the country of the Khatte (Hittites), and the "upper ocean of the setting sun. I brought them under my gov-"ernment. I placed them under the Magian religion, and I im-"posed on them tribute and offerings."

Great as was Tiglath-Pileser's victory, his stubborn foes did not quietly submit to Assyrian dictation. Tiglath-Pileser's successors were less fortunate, and were forced to continue the struggle against the Hittites for four centuries. From the abundant materials handed down to us, and throwing much light on the reign of Assur-Nasir-Pal, we learn that this monarch conquered Lebanon, Tyre and Sidon. The references to the Hittites are numerous, clear and important. From them we learn that Assur-Nasir-Pal defeated Carchemish, enriched himself with its booty, laid Gaza under tribute, besieged Kanulua, which was unable to withstand the attack of Assyria, and willingly paid a large ransom and gave hostages as a pledge that it would keep the peace in days to come. The careful reader of these inscriptions is struck with the fact of the Hittite power being divided, and on the wane.

This could scarcely be otherwise, because the Hittites were divided into petty kingdoms, whereas their rivals, Egypt and Assyria, were united forces, acting from central and intelligent motives. Assyria seems to have attacked and subdued each of the Hittite Kings in detail. It may have been local jealousies that led to this result, or it may have resulted from the fact that no separate Hittite State was powerful enough to force the others to gather around it, and unitedly, as in the great battle of Megiddo against Egypt's hosts, to oppose Assyria.

Shalmaneser, the son and successor of Assur-Nasir-Pal, prosecuted the war against the Hittites. Most of his thirty campaigns were conducted against the Hittites—campaigns that must

have impoverished the Hittites and almost decimated their lands. Crossing the Euphrates he captured Dabigu and the cities dependent on it. Learning by defeat one of the sources of their weakness, the Hittites enter into a confederacy to oppose the Assyrians. Benhadad, of Damascus, Irkhulina, of Hamatte, and others, join the Hittites, in the hope of crushing the might of Assyria. Shalmaneser declares, "by the command of Assur, the great lord, my "lord, with them I fought A destruction of them I made. Their "chariots, their war carriages, their furniture of battle I took from "them. Twenty thousand five hundred men with arrows I slew." It becomes tiresome to read the accounts of the annual attack and defeat of the Hittites.

When Sargon came to the throne in 721 B. C., the Hittite power was in its death throes. In 717 B. C., they make their final stand at Carchemish, and are crushed beyond all hope of recovery. Listen to the story of their ruin, as told by their spoiler Sargon: "In the fifth year of my reign, Pisiri of Carchemish sinned "against the great gods, and sent against Mita the Moschian, messages hostile to Assyria. He took hostages. I lifted my hands to "Assur, my lord. I made him leave the town. I sent away the "holy vases out of his dwelling. I made them throw him into "chains of iron. I took away the gold, silver and treasures of his "palace. The Carchemish rebels who were with him and their property I transplant d to Assyria, I took among them fifty cars, "two hundred riders, three thousand men on foot, and I augmented "the part of my kingdom. I made the Assyrians to dwell in "Carchemish, and I placed them under the dominion of Assur, my "lord."

Whatever may be our views as to the part played in the great battle-field of the world by the Hittites, we must admire their valour and be impressed with a sense of their greatness—a greatness that held Egypt at bay on the south and Assyria on the east—a greatness that defied all foes, and manfully maintained a national existence for a longer period than Babylon, Assyria, Greece or Rome.

This wonderful nation stood in very close relation to the Hebrews. In different ways they pass and repass on the stage of Old Testament history. Does Abraham look for land for himself and for his descendants? Part of it is in the possession of the Hittites. How does he secure his first possession of this land?

By purchasing a grave, in which to bury Sarah, from the Hittites of Hebron. Where was the body of this distinguished patriarch laid after death? It was lovingly placed by his two sons, Isaac and Ishmael, by the side of Sarah, "in the cave of Machpelah, in the field of Ephron, the Son of Tohar the Hittite. From what stock did Esau take his wives? From the Hittites. Who are declared to be the occupants of Canaan in the days of Moses? The Hittites and others. Who are the foes most to be dreaded by the Israelites? The Hittites, the hardy mountaineers. What is the extent of the land given to Joshua? "From the wilderness and this Lebanon, "even unto the great river, the river Euphrates, all the land of the "Hittites, and unto the great sea, toward the going down of the sun, "shall be your coast." Who are the foes Joshua is called on to face as he crosses the Jordan? It is the Hittites, and their companions from the mountains, the Amorites. Who oppose him every step and are in great force at the decisive battle of Merom, in the hope of driving back the invader? The Hittites. Who, though crushed, continued to influence the Hebrews, link themselves in marriage, and gain respect for their gods? The Hittites. Who, though aliens, made a name for themselves in David's army? The Hittites. With what alien people was Solomon most closely connected? With the Hittites, for his Mother Bathsheba was the wife of Uriah, the Hittite, and in his harem were Hittite women. What two peoples bought horses in Egypt in the days of Solomon? The Hittites and the Hebrews? What caused the Syrians to fly panic stricken from the siege of Samaria? Because they thought the King of Israel had hired the Hittites and sent them against the Syrians. From the Biblical references we infer that the Hittites were a powerful and warlike people—an inference confirmed by the monuments of Egypt and Assyria.

But here let us try to get some light on Hittite nationality, learning and religion.

Who were the Hittites is a question not so easily answered as some would suppose. Before an answer can be given we must study the story of the Bible, of the Egyptian and Assyrian monuments, of the Hittite names and literature. From Genesis, x, 15, we learn that the Bible regards the Hittites as a branch of the Canaan-ite stock: "And Canaan begat Sidon his first born, and Heth." According to this the Hethites or Hittites descended from Canaan,

and are to be ranked among the Hamite race. In the narratives of the purchase of the cave of Machpelah the Hittites are called, in the original Hebrew, " Bene-Cheth," sons of Heth. This explains the language of Abraham in relation to those dwelling in Canaan in his day—the Canaanites and the Hittites. He speaks of them as neither of his country nor of his kindred. How natural in case the Hittites are descended from Ham! The names of the Hittites found in the monuments might point to a Semitic origin. The same might be said of Hittite names found in the Bible. Thus the names of Esau's wives are Hebrew. Genesis, xxvi, 35, represents Esau as taking to wife Judith, the daughter of Beeri the Hittite, and Bashemath, the daughter of Elon the Hittite. Here the nationality is Hittite, and the names in every instance Semitic. Judith means "the praised," Beeri "the fountains," Bashemath "the fragrant," and Elon "the strong hero." But in Genesis, xxxvi, 2, Judith is called Aholibamah and her father Anah. Dr. Wright suggests an idea which seems to me the right explanation of those double names—the idea that Aholibamah and Anah are the Hittite names. What can be more natural than that the Hebrews should give Hebrew names to their Hittite friends and relations? The fact of having a Semitic name does not warrant the conclusion that the bearer is of Semitic nationality. Besides most of the Hittite names are not Semitic. We have the high authority of Professor Sayce for saying that "the Hittite proper names preserved on the Egyptian and Assyrian monuments show that the Hittites did not speak a Semitic language." As an evidence of this the Hittite proper names, used to define some quality in those bearing them, have the defining word first, whereas the Hebrews place it last. The term Melchisedek means king of righteousness—the Melchi meaning king and the sedek righteousness. Here the Hebrew method is followed by the placing of the qualifying word last—a method reversed by the Hittites. But the fact of the Hittite mode of using grammatical suffixes is even more significant. Instead of using both suffixes and affixes, as in the case of the Semitic languages, the Hittites used affixes, and affixes alone.

The Hittite sculptures show that they are not to be ranked in the list of Semitic peoples. In type and feature they are the children of the north; in the moccasin sandals with upturned toes, such as are worn by the mountaineers of Asia Minor and Greece at present, and in the fingerless glove worn only in cold countries, we

have hints of their old home being in the north, and in mountainous regions. The Bible places them in the mountains in the north. Thus when the spies return to Moses, and tell what they saw, as we learn from Num., xiii, 29, they say "that the Amalekites dwell in the "land of the south; and the Hittites, and the Jebusites, and the Amor-"ites, dwell in the mountain; and the Canaanites dwell by the sea "and by the coast of Jordan." Captain Conder, in his recent work entitled "Syrian Stone Lore," inclines to the belief that the Hittites may be a branch of the early Turanian stock. He says that they "were certainly not a Semitic race, nor do they appear to have been "closely akin to the old Egyptian stock. * * * * They were, "indeed, the overlords who ruled Semitic tribes, just as the Elam-"ites ruled Semitic tribes in Babylon; but the Egyptian sculptors "of the fourteenth century B. C., who have given us representations "of the Hittite warriors in their chariots, have carefully distinguished "them by a lighter complexion from their brown Semitic allies. The "general effect of the representation of the Hittites on the sculp-"tures of Karnak bears a striking resemblance to the Tartar type, and "the wearing of boots in place of sandals appears possibly, as Pro-"fessor Sayce has remarked, to point to the northern derivation of "the tribe, which is thought to have come from the Caucasus." The Hittites are generally represented on the monuments as almost hairless, their pig-tails giving them a Chinese appearance.

From the country they inhabited, we are led to infer that they may have been closely linked to the ancestors of the modern Georgian. The Assyrians and the Egyptians used the term Kheta, in a somewhat loose sense, to designate all the peoples living in Northern Syria, but not to designate any tribe north of the Taurus Chain. The Hittites are found as far south as Hit on the Euphrates, as Tell Hatteh near Kadesh, as Hatta and Kefr Hatta in Philistia, and as Hebron in Palestine. "The Hittites," to use the language of Conder, "may perhaps be considered at one time to have advanced "to the borders of Egypt, though in 1600 B. C. they were already "only found in the north. Thus in the time of Joshua and "Solomon the land of the Hittite is Northern Syria. Mariette Bey "proposed to identify the Hyksos with the Kheta;" and, in case this can be done, an explanation of the noticeable non-Semitic trace on the Hyksos will be given.

Professor Sayce in his work on the Ancient Empires of the

East designates the Hittites as the most important branch of the Proto-Armenian race. He thus puts his views: "As Asia Minor "was but a prolongation of Armenia, so too, originally, its popula- "tion was the same as that which in pre-historic days inhabited the "Armenian plateau. From thence it spread westward and south- "ward, down the slopes of the mountains, under the various names "of Hittites, Moschi, and Titareni, Komagenians, Kappadokians, "and the like. We may term it Proto-Armenian, and see in the "Georgians its modern representatives, though doubtless the Circas- "sians and other half extinct races, which, before the Russian con- "quest, found a refuge in the fastnesses of the Caucasus, once had "share in populating the neighboring regions."

Turn now to the evidence of the literary and artistic standing of the Hittites. Their enemies sneer at them as the lovers of books, and one of the towns in Southern Palestine is called Kirjatte-Sepher or book town. Before the introduction of the Phœnician alphabet into Asia Minor a Hittite syllabary was used, the syllabary now termed Asianic. In Cyprus as late as the fourth century B. C. this sylla- bary was used. Through Hittite sources the philosophic ideas of the east poured into the west, and gave a colouring to the early Ionic thinking. The resemblance between the Hittite writings and those of Egypt show close contact and intercommunion. Through this Europe was linked to Egypt; for the Hittites touched Greece on the west, as we learn from the works of Homer. On the suppo- sition that one of the Hyksos dynasties was Hittite it may be infer- red that the Hittites were not ignorant of astronomy or of mathe- matics. Professor Eisenlohr tells us that the Hyksos princes did study such questions. In art the Hittites made considerable progress. As their literature was founded on, and powerfully moulded by their neighbors, the Egyptians and early Babylonians living before the rise of the Assyrian empire, as in like manner was their art. They seem to have taken the artists of early Babylon as their models, and, having added new ideas from Egypt, introduced the Eastern forms into Asia Minor, and through the gate-way of Asia Minor into Europe. Professor Sayce says of Hittite art, "it "was characterized by roundness and work in relief. The mural "crown was a Hittite invention; the animal forms, in which Hittite "artists specially excelled, were frequently combined to form compo- "site creatures, among which may be mentioned the double-headed

"eagle, afterwards adopted by the Seljukian sultans, and carried by "the crusaders to the German States. This Hittite art is the source "of the peculiar art of Asia Minor, which forms a well marked "element in that of primitive Greece." In the cylinders, sculptures and seals found in Asia Minor and in the islands of the Archipelago; in the raised silver boss characters and in the gold rings designed after ancient Babylonian models, we have proofs of the skilled hand of the Hittite artist.

Before concluding, I wish to state in a few words what is known of Hittite religion. And here again the Hittites take their first lessons in Babylonia, and, having made some progress, they communicate what they have received from Babylonia, and modified, to the west. The gods of Babylonia appear on Hittite soil with new names, retaining their old faces and forms. Even the legends, forms of worship, and images are imported, almost without a change. In the Amazon of the Greek, we have the reproduction of the Hittite priestess. Prof. Sayce notices a very peculiar and interesting fact in this connection—that the cities founded by Amazons—Ephesos, Smyrna, Kyme, Myrina, Priene, Pitane—were all of Hittite origin. In early art the Amazons are robed in Hittite costume and armed with the double-headed axe, and the dances they performed with shield and bow in honor of the goddess of war and love, gave rise to the myths which saw in them a nation of warriors. The debasing rites of the Babylonish religion were introduced into the Hittite system, and mutilation and torture were practised to please the cruel Attys. Istar and Set were their chief gods. Set, whom they called king of heaven and earth, appears to be the ancient god of Egypt of the same name. Conder says that the Egyptians regarded Set as the great god of night, at once the brother and foe of Horus; that Set assuming the form of a boar swallowed the eye of the god of day. The priestesses ministering at the Hittite altars were mere ritualists, and religion was in their case, as it too often is, divorced from morality. At Kadesh, Hittite girls were devoted to wickedness, and that in the name of the Hittite religion. Many were the forms of worship, and most of them repulsive in the extreme. "Devotees "surrendered their children to Baal in the flames, and the children's "screams were drowned by trumpet and drum; and the rites of

"Astarte were equally vile, though accompanied by the cooing of "doves and clouds of incense."

But going hand in hand with this base ritual, there were in the Hittite faith elements of the old nature worship of Armenia and of Asia Minor. Hence the wild dances, the mystic wanderings through the woods, the clanging of cymbal and of tambourine. Conder shows that the general character of the religion of the Turanian tribes, of which he supposes the Hittites to be one, is in its main features like that of the Hottentots. Indeed the Hittites grafted the Babylonian and Egyptian ideas on the animism of the Turanian—the invocation of mountain, river, cloud and storm, and the more abstract ideas of Babylonia and of Egypt were mixed, and thus grew up a system that gave to Greece ideas and forms familiar to the students of Greek and Roman literature.

THE LAKE ERIE SHORE AS A BOTANIZING GROUND.

Read before the Biological Section, February 15th, 1889,

BY T. J. W. BURGESS, M. B.; F. R. S. C.

Perhaps few, if any of you are aware that almost at our very doors, certainly within easy reach of the members of this Association, lies what is probably the best botanizing ground in Ontario, I might even say the best in Canada if we exclude British Columbia and the Rocky Mountains. I refer to the shores of Lake Erie, a region less known botanically than any other part of the Dominion, except the parts I have mentioned. While the counties immediately adjoining the lake constitute the district to which I specially refer, it may be said to include the banks of the Niagara, Detroit and St. Clair Rivers, and the border of Lake St. Clair.

Forty-nine years ago Sir Wm. J. Hooker published his great work, the "Flora Boreali Americana," and in it recorded all then known, through the early travellers and explorers, of our species and their distribution. In 1840 to 1843 appeared the "Flora of North America" by Torrey and Gray, and in 1878, the latter gentleman published the first volume of his "Synoptical Flora of North America," comprising the Gamopetalæ after Compositæ. These works virtually contained all that was known of Canadian botany, except occasional lists which had from time to time appeared in scientific publications, up to 1883, when the first part of Professor Macoun's "Catalogue of Canadian Plants" was brought out. This part, which comprised the Polypetalæ, was followed in 1884 by a second, treating of the Gamopetalae, and in the same year appeared the second volume of Gray's "Synoptical Flora," completing the Gamopetalous Dicotyledonous plants. In 1886 and 1888, two other parts of Prof. Macoun's great work were issued, treating, respectively, of the Apetalæ and the Endogens. This wonderfully comprehensive catalogue is now our standard work on the number and distribution of Canadian species, and forms a lasting monument of the good work done by Mr. Macoun for the science he loves so well, and which he has done so much to foster in this country. It has thrown the first

great light on our Canadian flora, but even it, as the author on several occasions remarks in its pages, is woefully deficient as regards the flora occupying the region along Lake Erie, in which, no doubt, there are many varieties still to be brought to view.

One of the earliest explorers to leave any special notes on the vegetation of the Lake Erie district, was the famous Franciscan monk, Father Hennepin, who accompanied LaSalle on his voyages, extending from 1679 to 1682. Hennepin explored the country through the region of the St. Lawrence and great lakes, westward into Wisconsin, where he was carried as a captive by the Indians. He appears to have made no collections, nor did he give any special account of the botany of these regions, but on more than one occasion he speaks of the prevalence of walnut, chestnut and plum trees about Lake Erie.

Following Hennepin, the Jesuit, Charlevoix, who reached Quebec in 1720, travelled by way of the St. Lawrence and great lakes and thence descended the Mississippi. His journals contain some notes of interest, and he speaks particularly of the fine timber in the Erie region, mentioning the white and red oaks (*Quercus alba* and *Quercus rubra*) and three kinds of walnut, two of which, from his description, evidently are the butternut and one of the hickories.

Peter Kalm, a pupil and correspondent of Linnæus, in 1749; Frederick Pursh, the celebrated author of the "Flora Americæ Septentrionalis," in 1806; Michaux, the younger, in 1807; and Drummond and Douglas, distinguished botanical explorers, about fifteen or eighteen years later made expeditions to the Niagara River and eastern end of Lake Erie, but can hardly be said to have explored any of its northern shore. The result of their labors was recorded in Hooker's Flora.

The first real investigators of the Flora of this district were Mr. Goldie and Drs. Todd, Maclagan and Nichol, and they have recorded many interesting plants, some of which have not since been seen. Professor Macoun has explored to a limited extent the Niagara Peninsula, Pelee Island and the country along Lake Erie westward from that point and up the Detroit River; while, personally, I have examined the districts about Point aux Pins and Point Pelee. Mr. David F. Day, President of the Buffalo Natural History Society, has carefully explored the Canadian side of the Niagara River

and the shore of Lake Erie as far as Point Abino. The shore, however, between Point Abino and Point aux Pins, a stretch of about 175 miles, remains practically unexplored, with the exception of a little work done by Dr. Nichol and Mr. Wm. Yates in Norfolk County, by Prof. Macoun in the same district about Port Dover, and by the last named gentleman and myself about St. Thomas and Port Stanley in Elgin County. That much is still to be done is evidenced by the discovery during the past season by one of our members, Mr. Hanham, who makes no claim to even the slightest knowledge of botany, of the beautiful and showy *Phlox coronopifolia* introduced at Port Dover, an addition to our Canadian Flora. The island known as Long Point lies about the centre of the unexplored district, and I have no doubt would yield a generous harvest of new plants to any one with time to visit and work it up.

What I have called the Erie District is chiefly remarkable for the southern nature of many of the species, some of them being so much so that one would scarcely dream of finding them within our boreal confines. The large size and plentitude of the Kentucky coffee-tree, the pawpaw, mulberry, blue ash and sour-gum trees, clearly show them to be indigenous, and would indicate that they are not merely chance survivors, but that the soil and climate fully meet their requirements. To this region having been but scantily investigated may be attributed the seemingly extraordinary fact that on a trip made to Point Pelee, in the summer of 1882, by Prof. Macoun and myself, in one day we noted no less than eleven species not before recorded as occurring in Canada, and ten additional ones but very rarely met with. In the week preceding our joint trip the Professor had found, about Amherstburgh and on Pelee Island, eight others, which then for the first time found a place in our flora. The vegetation in many respects resembles that of the northern parts of Pennsylvania and Ohio, lying on the opposite or southern shore of the lake, but whether this points toward proving that what is now water was formerly land and connected the two countries I do not pretend to say. In some instances, notably that of the three-thorned acacia (*Gleditschia triacanthos*) some fine specimens of which grow in the sand-dunes on Point Pelee, I have no doubt but southern plants have been introduced through seeds drifting across the lake. The short distance inland to which some of the species extend has always seemed to me a strong argument in favor

of this view, there being seemingly no difference in soil or climate sufficient to account for it. The forest of this region differs markedly from that of any other part of Canada, for while the trees, elsewhere the chief components, occur, the bulk of it is made up, in addition to those I have already named, of chestnut, black walnut, tulip-tree, buttonwood, white-heart and broom hickories, butternut, chestnut oak, scarlet oak, and black oak.

From Prof. Macoun's Catalogue I have prepared two lists; one giving the names, localities and authorities for the occurrence of the Phænogamous species peculiar (so far as known) to the Lake Erie region; the other those very rarely noted as occurring elsewhere in Canadian territory. The former includes 108, the latter 26 species. These combined lists give us 134 plants, out of a total of 2955, restricted, or almost restricted, to this district, that is, a twenty-second part of all the plants known to occur over our vast territory, from the Atlantic to the Pacific, are confined to it, and I have no doubt that quite a number of additional ones will be brought to light when the country is fully worked up.

113 out of the 737 genera known in Canada, or rather more than one-seventh, are represented in the same region, while very nearly one-half the orders, or 54 out of 118, occur. The orders most largely represented in these two lists, as one might naturally expect from their size, are the Leguminosæ, Rosaceæ, Compositæ, Labiatæ, Liliaceæ, Cyperaceæ and Gramineæ, but, if we go by the proportion of the species to those forming the order in Canada as a whole, the ones best represented are Caryophyllaceæ, Umbelliferæ, Juglandaceæ and Cupuliferæ. Ranunculaceæ and especially Ericaceæ, judged by the same standard are, by all odds, the lowest in the scale of numbers. Four of our Canadian orders find their sole representatives in the Lake Erie District, viz: Magnoliaceæ *(Magnolia Family)* by Magnolia acuminata and Liriodendron Tulipifera, Anonaceæ *(Custard-apple Family)* by Asimina triloba, Bignoniaceæ *(Bignonia Family)* by Tecoma radicans, and Hemodoraceæ *(Blood-root Family)* by Aletris farinosa; while of the two representatives in Canada of the Illecebraceæ *(Knawel Family)* one, Anychia dichotoma, occurs here, the other, Paronychia sessiliflora, in the Northwest Territory.

A very curious fact that cannot but strike one forcibly in glancing over these lists is the large number of species, noted by the

older writers, such as Pursh, Hooker and Goldie, which have not since been seen. This is possibly due to two facts, first, that the region has been but comparatively little explored by botanists, and second, that these writers did not give any very definite localities to aid one in the search. In many cases the sole reference to guide us is Canada or Western Canada, both of which, as you are well aware, are pretty extensive localities to cover. It is possible, also, that some of the species have been incorrectly named. The number of such species is 22, and it is to these I would now particularly call your attention. Indeed, such is the main object of this paper, for it is very necessary in the interests of botanical research that these species, if existing, should be more definitely relocated. Any of you, interested in botany, and having a holiday, cannot do better than spend it on some part of the Erie shore. You are liable to come across some of these, or new, floral rarities at any moment, and, even if you do not, I can promise you that you will be amply repaid with vasculums or presses stocked with some of the least common of Canadian plants. Do not let the fact that such plants have been so long hidden deter you or make you doubt their occurrence there. In even comparatively well botanized districts, with almost an army of scientists engaged in the search, it is possible for a plant to remain concealed for years. A notable example of this is seen in the rare American shrub Shortia galacifolia. Over a hundred years ago, viz. in 1788, the elder Michaux, on a journey into the mountains of North Carolina in search of living plants of the rare Magnolia cordata, collected somewhere on those mountains a specimen of an Ericaceous plant, out of flower but with immature fruit. In 1839 Dr. Gray found and examined, in Michaux's herbarium, this specimen, the exact locality for which was unfortunately not recorded, and on it founded, in 1842, a new genus, Shortia, so called in honor of Dr. Chas. W. Short of Kentucky. Lyon, Curtis, Gray, and a host of less noted botanists, in vain traversed the Carolina mountains to rediscover Michaux's locality for the species, but it was not until May, 1877, that Mr. Geo. Hyams found it on a hillside in McDowell County, North Carolina, east of the Black Mountain. For several years after this was supposed to be the only station for the species, and, to the regret of all botanists, the plants were few in number. In 1886, however, a new station was discovered by Mr. Kelsey on the banks of the lower Whitewater River, in Jocassæ

Valley, Oconee County, about 33 miles from Highlands. Here there were rods of the banks covered with it and it extended up and down the river, more or less, for three miles, so that this formerly rarest of plants was at last found in sufficient abundance to assure its continuance.

Another instance of the rediscovery of a plant is that of *Nymphæa elegans*, which was originally collected, by Dr. Charles Wright, in a pond near the head of the Leona River, Texas. Neither Lindheimer, Fendler, nor any other Texan collector or botanist was able to find it again, and for nearly forty years it stood in the North American flora on the strength of a single collection at a single vaguely described station on the broad plains of South-western Texas. In 1887, however, it again came to light near Waco in the same State, Messrs. Trimble and Wright having found it abundant in one place there. These are only two of several such instances, and I trust will encourage the various members of this Association to aid in hunting up some of the lost or doubtful species mentioned by Professor Macoun as occurring in the Lake Erie region. The following is a list of them, some, as you will note, being actually recorded as found by Mr. Buchan and Judge Logie at Hamilton here.

1. *Nelumbium luteum*, Willd., (Water Chinquepin) Reported as found in the Detroit River, at the Erie entrance to the Welland Canal, and near Burnham's Island in Grand River a few miles from Dunnville. Neither Prof. Macoun nor myself have seen Canadian specimens of this plant, but believe the stations named to be authentic.

2. *Polygala incarnata*, L. Found in rocky places on the Niagara River, near the Falls, by Douglas in 1823, and not since detected.

3. *Silene stellata*, Ait. Also found by Douglas in 1823 in dry stony places on the Niagara River and not since seen.

4. *Silene nocturna*, L. Observed growing near Fort Erie in 1881 by Mr. Day, but not collected since.

5. *Hypericum Sarothra*, Mx. Recorded in Torrey and Gray's Flora as a native of Canada, but we have no proof of its occurrence. As Prof. Macoun says, however, it may be found in sandy soil along Lake Erie.

6. *Baptisia leucantha*, T. & G. Not detected since the time

of Goldie, who records it as occurring in rich alluvial soil on the shore of Lake Erie. I am myself of the opinion that *Baptisia tinctoria*, which occurs as described, is the species referred to, but am at a loss to understand how such an error could have been made. It is of course quite possible that I am wrong in my conjecture and that *Baptisia leucantha*, which is a native of Ohio, may yet be rediscovered.

7. ***Sedum ternatum***, Mx. Rocks in the Niagara River and Lake Erie (*Douglas*, 1823); vicinity of Hamilton, Ont. (*Buchan*) Prof. Macoun says this is a doubtful species and should be carefully looked for and verified.

8. ***Ludwigia alternifolia***, L. In swamps, Canada. (*Hooker*, Fl. Bor. Am.—*Torrey and Gray*, Fl. N. Am.) Another doubtful species. No exact locality is ascribed for it by these authors, but if it occurs with us at all it will probably be along the Lake Erie shore.

9. ***Archangelica hirsuta***, T. & G. Both Pursh and Michaux credit this species to Canada, but do not say to what part. If found it will almost certainly be in the neighborhood of Lake Erie.

10. ***Liatris squarrosa***, Willd. Dry gravelly or sandy soil, Western Ontario (*Gray*) Neither this species nor its variety *intermedia*, D C., which occurs in the same situations as the type, have been noticed by any of the late collectors.

11. ***Helianthus parviflorus***, Bernh. Thickets in alluvial soil in Western Ontario (*Goldie*, vide *T. and G.*, Fl. N. Am.)

12. ***Cacalia atriplicifolia***, L., (Indian Plantain) Canada (*Cleghorn*, vide *Hooker*) Moist woodlands, Western Ontario (*T. and G.*) Not collected recently.

13. ***Krigia Virginica***, Willd. Sandy ground, Western Ontario (*Gray*)

14. ***Sabbattia angularis***, Pursh. Rich soil, Western Ontario (*Gray*) Prof Macoun says that this species as a Canadian plant is unknown to him. My friend, Mr. Yates, of Hatchley, Ont., tells me he once found a Sabattia in the Erie district but did not know the species and had lost the specimen. It is probable that it was the same as Gray refers to.

15. ***Pycnanthemum incanum***, Mx. Dry soil, Canada (*Goldie*) New England to Western Canada (*Gray*) Hamilton, Ont. (*Logie*)

Prof. Macoun says he has never seen a Canadian specimen, nor have I myself.

16. *Monarda Clinopodia*, L. Western Canada to Illinois (*Gray*) Prof. Macoun knows nothing of this species as a Canadian plant. It is to be looked for in the Lake Erie region.

17. *Scutellaria canescens*, Nutt. River banks, Western Ontario (*Gray*) Canada (*Goldie*) Prof. Macoun has no knowledge of Canadian localities for this species. If found it will probably be along Lake Erie.

18. *Anychia dichotoma*, Mx. Shore of Lake Erie, Norfolk Co., 1867 (*Dr. Nichol*) Has not been since reported.

19. *Corallorhiza odontorhiza*, Nutt. Woods along Lake Erie, Norfolk Co. (*Dr. Nichol*) It is also recorded from Halifax, Montreal, and Hamilton, but it is more than likely that all these references should be to *Corallorhiza innata*, as all the specimens, so-called, seen from those localities by Prof. Macoun have been that species. If it really occurs with us it will be in the Erie District only, I think.

20. *Pogonia pendula*, Lindl. Damp woods, Canada (*Goldie*, vide *Hook.*, Fl. Bor.-Am.) Prof. Macoun has never seen a Canadian specimen. Must inhabit the Erie region if it occurs at all.

21. *Melanthium Virginicum*, L. Upper Canada (*Hooker*) Prof. Macoun has never seen a Canadian plant of this species either. It is to be looked for along the Lake Erie shore.

22. *Aristida dichotoma*, L. Port Colborne, Lake Erie (*McGill Coll. Herb.*) Another, and the last, of these plants of which Mr. Macoun has seen no Canadian specimen.

Species restricted in Canada (so far as known) to the Lake Erie District.

1. *Ranunculus ambigens*, Watson. In inundated places or mud. Southern part of Ontario (*Goldie*) Vicinity of Port Colborne (*McGill Coll. Herb.*)

2. *Magnolia acuminata*, L., (Cucumber-tree) The only recorded station for this is Falls of Niagara on the authority of

L'Abbé Provancher. Whether he considers it introduced or not I am unable to say, but I should most certainly judge that it is.

3. *Asimina triloba*, Dunal, (American Papaw) Rich low woods near the railway below Queenston Heights; very abundant on Pt. Pelee and in the townships bordering Lake Erie between that point and Amherstburgh; doubtless not rare along Lake Erie but not reported (*Macoun*)

4. *Nelumbium luteum*, Willd., (Water Chinquepin) Reported as found in the Detroit River, at the entrance from Lake Erie to the Welland Canal, and near Burnham's Island in Grand River, a few miles from Dunnville, Ont.

5. *Corydalis flavula*, D C., (Yellow Corydalis) Abundant around the stone quarry on the north end of Pelee Island, and on Pt. Pelee (*Macoun and Burgess*) Pt. Abino on Lake Erie (*Day*)

6. *Sisymbrium Thaliana*, Gaud. Pt. Abino, Lake Erie. This is our only recorded station, but Mr. Day, who discovered it, says it is abundant and he thinks indigenous.

7. *Viola pedata*, L., (Bird-foot Violet) The sole known locality we have for this very handsome species is Tp. of Charlotteville, Norfolk County, Ont., where it is very abundant in open sandy soil (*Burgess*) My specimens exhibit both the type and the var. *bicolor* of Pursh. All other recorded references to this species refer to *Viola delphinifolia* of Nutt., which is common on the western prairies.

8. *Viola palmata*, L. This, the *Viola cucullata*, var. *palmata* of Gray's Manual, is recorded only from damp woods near Amherstburgh, Ont. (*Macoun*)

9. *Polygala incarnata*, L. Found in rocky places on the Niagara River, near the Falls, by Douglas in 1823.

10. *Silene stellata*, Ait. Also found by Douglas, in 1823, in dry, stony places on the Niagara River.

11. *Silene nocturna*, L. Observed growing at Fort Erie, Ont., in 1881 (*Day*)

12. *Dianthus armeria*, L., (Deptford Pink) Introduced into the waste ground between Niagara Falls and the Canada Southern Railway (*Macoun*)

13. *Cerastium oblongifolium*, Torr. Low sandy woods close to Amherstburgh; Pt. Pelee and Pelee Island (*Macoun and Burgess*) A rare and beautiful species.

14. *Hypericum Sarothra*, Mx. In Torrey & Gray's Flora this species is recorded as a native of Canada, but we have no proof of its occurrence.

15. *Hibiscus moscheutos*, L., (Swamp Rose-Mallow) It is one of the handsomest flowers I know. Bright rose color or white, the blossoms often measure from 3-6 inches in diameter. Islands in the Detroit River (*Maclagan*) Marsh at the junction of Pt. Pelee to the main land (*Macoun and Burgess*) Roadside near Windsor, Ont. (*Dr. Kemp*) Islands in Niagara River (*Day*)

16. *Ptelea trifoliata*, L., (Shrubby Trefoil) Pelee Island (*Macoun*) West side of Pt. Pelee (*Macoun and Burgess*) A few specimens on the lake shore above Fort Erie, Ont. (*Day*)

17. *Euonymus atropurpureus*, Jacq., (Burning Bush) In shady woods and open thickets. White Island, opposite Amherstburgh (*Macoun*) Amherstburgh, Ont. (*Maclagan*)

18. *Trifolium reflexum*, L., (Buffalo Clover) Islands in the Detroit River (*Maclagan*) About Sandwich and Amherstburgh (*Douglas*)

19. *Tephrosia Virginiana*, Pers., (Goat's Rue) Covering acres of sandy soil along the Lake Erie shore on the 1st and 2nd Concessions of Charlotteville Tp., Norfolk Co. (*Burgess*)

20. *Onobrychis sativa*, Lam. Introduced at Pt. Abino, near Fort Erie, Ont. (*Day*)

21. *Desmodium canescens*, DC. Amherstburgh, Ont. (*Maclagan*) Abundant in low sandy thickets at Pt. aux Pins and Pt. Pelee, Lake Erie, Ont. (*Burgess*)

22. *Desmodium ciliare*, DC. Dry sandy thickets, Queenston Heights, 1877 (*Macoun*)

23. *Baptisia leucantha*, T. & G. Not detected since the time of Goldie, who records it as occurring in rich alluvial soil on the shore of Lake Erie.

24. *Gleditschia triacanthos*, L., (Three-thorned Acacia) A number of trees of this species were found by Prof. Macoun and myself, in the summer of 1882, growing in the sand dunes on Pt.

Pelee. The Professor's surmise is that the seeds had drifted across the lake from Ohio, as sand is not the true habitat of this species. It is quite a common tree in cultivation throughout Ontario.

25. *Geum vernum*, T. & G. Open, damp woods, Amherstburgh, Ont. (*Macoun*)

26. *Agrimonia parviflora*, Ait. Woods near Amherstburgh, Ont. (*Maclagan and Macoun*) This is probably the form referred to as *Agrimonia Eupatoria*, var. *parviflora* by Hooker in his "Flora Boreali-Americana."

27. *Rosa setigera*, Mx., (Climbing Rose) Borders of thickets and along fences about Amherstburgh, and on Pelee Island (*Macoun*)

28. *Cratægus Crus-galli*, L., (Cockspur Thorn) Abundant on Queenston Heights and westward to Amherstburgh, where also it was recorded by Maclagan (*Macoun*) About Lake Erie (*Douglas*)

29. *Saxifraga Pennsylvanica*, L. Low places near Fort Erie, Ont. (*Day*)

30. *Heuchera Americana*, L. Woods near Amherstburgh, Ont. (*Maclagan and Macoun*)

31. *Ludwigia alternifolia*, L. In swamps, Canada (*Torrey and Gray*, Fl. N. Am. *Hooker*, Fl. Bor.-Am.) A species of very doubtful occurrence in Canada.

32. *Lythrum alatum*, Pursh. Amherstburgh, Ont. (*Maclagan*) Low wet sandy places at Pt. Edward, Ont. (*J. M. Macoun*) In ditches along the G. W. Railway, four miles east of Windsor, Ont. (*Macoun*)

33. *Opuntia Rafinesquii*, Englm. In the sand at the southern end of Pt. Pelee (*Macoun and Burgess*) Said also to grow on Long Pt., Lake Erie.

34. *Thaspium barbinode*, Nutt. Foster's Flats, Niagara Falls, and on the Canada Southern Railway, between Colchester and Amherstburgh (*Macoun*) Chippewa and Detroit River (*Maclagan*) Pt. aux Pins, Lake Erie (*Burgess*) The referring of this species to London, Ont., on my authority by Prof. Macoun in Part I. of his Catalogue is a mistake, the specimen should have been placed under *T. aureum*.

35. *Berula angustifolia*, Koch. Near Port Colborne, Ont., July, 1882 (*Day*)

36. *Chærophyllum procumbens*, Crantz. Abundant on White Island, in the Detroit River, opposite Amherstburgh (*Macoun*)

37. *Archangelica hirsuta*, T. & G. Both Pursh and Michaux credit this species to Canada, but do not say where found.

38. *Archemora rigida* DC., (Cowbane) Sandy swamps near Colchester Station on the Canada Southern Ry. (*Macoun*) Amherstburgh (*Maclagan*) Leamington, Ont. (*Burgess*) Port Colborne, Ont. (*McGill Coll. Herb.*)

39. *Cornus asperifolia*, Mx., (Rough-leaved Cornel) Growing in sand on Pt. Pelee, Lake Erie (*Macoun and Burgess*)

40. *Nyssa multiflora*, Wang., (Pepperidge) One tree was seen in a field at Bismarck on the Canada Southern Railway (*Macoun*) Abundant in a swamp near Leamington, Ont. (*Macoun and Burgess*) Common report makes this a plentiful tree in many swamps, hence called "pepperidge swamps," in Essex Co., Ont.

41. *Galium pilosum*, Ait., (Hairy Galium) Vicinity of Queenston, Ont., and in sand at the southern extremity of Pt. Pelee (*Macoun*) Amherstburgh (*Maclagan*) Pt. aux Pins, Lake Erie (*Burgess*)

42. *Fedia olitoria*, Vahl. Sparingly introduced along Lake Erie, near Port Colborne, Ont. (*Day*) Amherstburgh (*Maclagan*)

43. *Vernonia Noveboracensis*, Willd., (Iron-weed) Canada (*Pursh*) Close to the railway station at Essex Centre, Ont. (*Macoun*) Amherstburgh (*Maclagan*) Prof. Macoun states that the Essex Centre reference should possibly be to *Vernonia altissima*, as only the leaves were obtained.

44. *Vernonia altissima*, Nutt. In damp places, St. Clair Flats (*J. M. Macoun*) Along the G. W. Railway and margins of fields, near Windsor, Ont. (*Macoun*)

45. *Mikania scandens*, L., (Climbing Hemp-weed) Moist shady places along streams. Amherstburgh (*Maclagan*)

46. *Liatris squarrosa*, Willd. Dry gravelly or sandy soil, Western Ontario (*Gray*)

47. *Liatris spicata*, Willd. Not uncommon in marshy meadows between Pt. Edward and Sarnia, Ont. (*J. M. Macoun*) Abundant in low sandy soil at Leamington, Ont. (*Burgess*)

48. *Aster ericoides*, Ait., var. *villosus*, T. & G. Port Stanley, Ont. (*Burgess*) Windsor, Ont. (*Macoun*)

49. *Silphium perfoliatum*, L., (Cup Plant) Rich soil along streams. Islands in Detroit River (*Maclagan*) In thickets along margins of fields, Windsor, Ont. (*Macoun*)

50. *Heliopsis lævis*, Pers. Dry thickets. St. Catharines and Amherstburgh, Ont. (*Maclagan*)

51. *Helianthus parviflorus*, Bernh. Thickets in alluvial soil in Western Ontario (*Goldie* vide *T. and G.*, Fl. N. Am.)

52. *Actinomeris squarrosa*, Nutt. Islands in Detroit River (*Maclagan*) Roadsides and along banks of River Thames, Chatham, Ont. (*Macoun*)

53. *Coreopsis trichosperma*, Mx., var. *tenuiloba*, Gr. Islands in Detroit River (*Maclagan*) Edge of marsh at junction of Pt. Pelee to main land (*J. M. Macoun*) Border of marsh at Rondeau, Lake Erie (*Macoun*)

54. *Coreopsis tripteris*, L. Amherstburgh and islands in Detroit River (*Maclagan*) Around marshes and along the G. W. Railway, near Windsor, Ont. (*J. M. Macoun*)

55. *Coreopsis verticillata*, L. Moist places and margins of swamps, Western Canada (*Gray*) On the beach near a marsh, a little west of Rondeau, Lake Erie (*Macoun*)

56. *Dysodia chrysanthemoides*, Lag. Rare. A railroad weed at Fort Erie, Ont. (*Day*)

57. *Cacalia atriplicifolia*, L., (Indian Plantain) Canada (*Cleghorn* vide *Hooker*) Moist woodlands, Western Ontario (*Torrey and Gray*)

58. *Krigia Virginica*, Willd. Sandy ground, Western Ontario (*Gray*)

59. *Lactuca Floridana*, Gærtn. Islands in Detroit River (*Maclagan*)

60. *Fraxinus quadrangulata*, Mx., (Blue Ash) Pelee Island (*Macoun*) Pt. Pelee, Ont. (*Macoun and Burgess*)

61. *Asclepias purpurascens*, L., (Purple Milkweed) Amherstburgh and islands in the Detroit River (*Maclagan.*)

62. *Sabbatia angularis*, Pursh. Rich soil, Western Ontario (*Gray*)

63. *Gentiana Saponaria*, L. Moist woods, Western Ontario (*Gray*) Fort Erie, Ont. (*Day*)

64. *Phlox subulata*, L., (Ground or Moss Pink) Sand hills near Simcoe, Norfolk County *(Dr. Nicholl)* Near Cayuga, Ont. *(Wilkins)* Very showy and abundant in sandy soil near Lake Erie, Charlotteville Township, Norfolk County, Ont. *(Burgess)*

65. *Gilia coronopifolia*, Pers. Introduced at Port Dover, Ont., 1888 *(A. W. Hanham)*

66. *Mertensia Virginica*, DC. Alluvial banks. Pt. Abino, Lake Erie *(Day)*

67. *Ipomæa pandurata*, Meyer, (Man-of-the-Earth) Dry ground, Western Ontario *(Gray)* In warm gravelly soil toward the southern end of Pt. Pelee *(Macoun and Burgess)*

68. *Cuscuta compacta*, Juss. Credited to Canada by Dr. Gray. Amherstburgh *(Maclagan)*

69. *Solanum Carolinense*, L. Sandy and waste grounds near Fort Erie, Ont. *(Day)*

70. *Gerardia purpurea*, L. Low and moist grounds, Canada *(Gray)* Niagara Falls and Pt. Pelee *(Burgess)* Windmill Point, Lake Erie *(Day)* The var. *paupercula* is common from the Province of Quebec to the Saskatchewan.

71. *Tecoma radicans*, Juss. (Trumpet Creeper) This species is either indigenous on Pelee Island and Pt. Pelee, or it has become so naturalized as to run wild and appear to be native. It is cultivated in other parts of Ontario as a garden flower for covering trellis-work.

72. *Pycnanthemum linifolium*, Pursh. Low wet meadows. Pt. Edward, Ont., 1884 *(J. M. Macoun)*

73. *Pycnanthemum muticum*, Pers., var. *pilosum*, Gr. Pt. aux Pins and Leamington, Lake Erie *(Burgess)*

74. *Melissa officinalis*, L. (Common Balm) Waste ground, Pelee Island *(Macoun)* Well established in two or three places at Niagara Falls, Ont. *(Burgess)*

75. *Monarda clinopodia*, L. Western Canada to Illinois *(Gray)*

76. *Lophanthus scrophulariæfolius*, Benth. Borders of thickets along the slopes of Queenston Heights, one mile beyond Queenston Station *(Macoun)*

77. *Scutellaria canescens*, Nutt. River banks, Western Ontario *(Gray)* Canada *(Goldie)*

78. ***Plantago cordata***, Lam. Along streams. Canada (*Pursh*) Amherstburgh (*Maclagan*) Ditches and swamps along the Canada Southern R'y. at Colchester Station, near Amherstburgh (*Macoun*)

79. ***Anychia dichotoma***, Mx. Shore of Lake Erie, Norfolk Co., 1867 (*Nicholl*) Has not been reported since and should be looked for in South-western Ontario.

80. ***Amarantus blitoides***, Wat. Well established at Pt. Edward, near Sarnia, Ont., 1884 (*J. M. Macoun*) Probably a railway introduction.

81. *Chenopodium ambrosioides*, L., var. *anthelminticum*, Gray. Lake shore, Fort Erie, Ont. (*Day*)

82. *Morus rubra*, L., (Red Mulberry) Rich woods bordering Lake Erie. Not uncommon from Niagara along the river to the Whirlpool; common on Pelee Island and frequently met with in the woods at Amherstburgh and northward to Windsor (*Macoun*) Sandy soil, Leamington, Ont. (*Burgess*)

83. *Morus alba*, L., (White Mulberry) Niagara Falls (*Macoun*) Sandy plains, Sarnia, Ont. (*Burgess*)

84. *Carya tomentosa*, Nutt., (White-heart Hickory) Rather rare in the Niagara Peninsula from Lake Ontario to Lake Erie (*Macoun*)

85. *Carya porcina*, Nutt., (Pig-nut or Broom Hickory) Not uncommon in the Niagara Peninsula in woods along base of Queenston Heights, about Niagara Falls, and at many points along Lake Erie to Amherstburgh and northward as far as Windsor, Ont. (*Macoun*)

86. *Juglans nigra* L., (Black Walnut) Once the commonest wood in the district of which we are speaking, and still plentiful in places from Niagara Falls to Amherstburgh (*Macoun and Burgess*)

87. *Quercus Prinos*, L., (Rock Chestnut-Oak) From the Niagara River, along Lake Erie, to Amherstburgh (*Macoun*) Common at Pt. Pelee (*Burgess*) Pt. Abino (*Day*)

88. *Quercus palustris*, Du Roi, (Pin Oak) Abundant in wet woods below Queenston Heights and along Lake Erie and the Detroit River to Windsor (*Macoun*) Pt. Abino (*Day*) Leamington (*Burgess*)

89. *Corallorhiza odontorhiza*, Nutt. Woods along Lake Erie, Norfolk Co. (*Nicholl*)

90. *Pogonia pendula*, Lindl. Damp woods, Canada (*Goldie* vide *Hook.*)

91. *Habenaria ciliaris* R.Br. Canada (*Goldie*) Low sandy soil, Leamington, Ont. (*Burgess*)

92. *Aletris farinosa*, L., (Colic root) Sandy thickets, Leamington, Ont., 1887 (*Burgess*)

93. *Smilax quadrangularis*, Pursh. Thickets in damp woods, Pt. Pelee (*Macoun*) Low woods near Leamington (*Burgess*)

94. *Camassia Fraseri*, Torr. White Island in the Detroit River opposite Amherstburgh, 1882 (*Macoun*)

95. *Erythronium propullans*, Gr. Rich soil, near St. Thomas, Ont., 1882 (*Macoun*)

96. *Melanthium Virginicum*, L. Upper Canada (*Hooker*)

97. *Juncus acuminatus*, Mx., var. *legitimus*, Englm. Shore of Lake Erie at Pt. Pelee and at Essex Centre (*Macoun*)

98. *Potamogeton pauciflorus*, Pursh., var. *Niagarensis*, Gray. Rapids above Niagara Falls (*Burgess*) Niagara River, near the brink of the "Hog's Back" (*Tuckerman*)

99. *Cyperus erythrorhizos*, Muhl. Pt. aux Pins, Lake Erie, Ont. (*Burgess*)

100. *Carex Steudelii*, Kunth. On banks along the lake at Port Stanley, 1882 (*Macoun*)

101. *Carex cephalophora*, Muhl., var. *angustifolia*, Boott. Abundant in rocky, grassy thickets on Pelee Island, Lake Erie (*Macoun*)

102. *Carex virescens*, Muhl. Open woods, Niagara Falls, Essex Centre and Amherstburgh (*Macoun*) Low woods, Leamington (*Burgess*)

103. *Carex triceps*, Mx. Abundant in rocky thickets, Queenston Heights and Foster's Flats, Niagara Peninsula (*Macoun*)

104. *Carex grisea*, Wahl. Damp thickets, Port Dover Junction, Elgin Co., Ont. (*Macoun*)

105. *Aristida dichotoma*, L. Port Colborne, Lake Erie (*McGill Coll. Herb.*)

106. *Triplasis purpurea*, Chap. Sandy shore, Pt. Pelee and Pt. aux Pins (*Burgess*)

107. *Eragrostis major*, Host. Introduced along the railway at Pt. Edward, near Sarnia, Ont. (*J. M. Macoun*) Windsor, Ont. (*Macoun*)

108. *Eragrostis Purshii*, Schrad. Introduced along the railway. In fields at Port Colborne and Windsor (*Macoun*)

Species in Canada almost restricted (so far as known) to the Lake Erie District.

1. *Cimicifuga racemosa*, Nutt., (Black Snake-root) Rich woods, Cayuga, Haldimand Co. (*Maclagan*) Norfolk Co. (*Nicholl*) Squaw Island, Niagara River (*Day*) Also found by Mr. Geo. Prescott in the vicinity of Galt, Waterloo Co., Ont.

2. *Liriodendron Tulipifera*, L., (Tulip-tree. White-wood) Though extending throughout the western peninsula of Ontario, from Hamilton to the Township of Tuckersmith, Huron Co., it is really only found plentiful and in perfection in what may be called the Lake Erie District, where, with the black walnut, it once formed the great bulk of the forest. When covered with its large tulip-shaped blossoms, about the first of July, it forms an object of beauty that once seen can never be forgotten.

3. *Lechea major*, Mx., (Greater Pinweed) Sandy woods near Port Dover Junction (*Macoun*) Sandy soil, Windsor, Ont. (*J. M. Macoun*) Pt. Pelee (*Burgess*) Also found by myself in sandy woodlands at London, Ont.

4. *Polygala sanguinea*, L. Sandy ground, Sandwich, Ont. (*Maclagan*) Pt. Pelee, Ont. (*Burgess*) Windsor, Ont. (*J. M. Macoun*) Also reported by Logie and Buchan as occurring in dry ground at Hamilton, Ont.

5. *Silene Virginica*, L., (Fire Pink) Islands in the Detroit River (*Maclagan*) but also reported from Lake Huron by Dr. Todd. This is probably the species referred to by Hooker, in his "Flora Boreali-Americana," as *Silene Pennsylvanica*, occurring on rocky islands on the north side of Lake Erie, he not having seen the specimens.

6. *Vitis æstivalis*, Mx. Abundant on Pelee Island and Pt. Pelee; Foster's Flats below the Whirlpool, Niagara River; and in thickets around Queenston Heights (*Macoun*) Vicinity of Hamilton, Ont. (*Buchan*)

7. *Baptisia tinctoria*, R.Br., (Wild Indigo) Sandwich, Ont. (*Maclagan*) Sandy thickets near Leamington, Ont. (*Macoun and Burgess*) Oak-wooded plains of Charlotteville Tp., Norfolk Co. (*Yates*) Windsor, Ont., in sandy thickets (*J. M. Macoun*) Vicinity of Hamilton, Ont. (*Logie*)

8. *Poterium sanguisorba*, L. Well established at Pt. Abino on Lake Erie (*Day*) This species was detected during the past summer by our fellow-member, Mr. J. Alston Moffatt, in Halton Co., where he reports it as becoming quite a troublesome garden weed.

9. *Sedum ternatum*, Mx. Rocks along the Niagara River and Lake Erie (*Douglas*) Vicinity of Hamilton, Ont. (*Buchan*) As Prof. Macoun says this is a doubtful species and should be carefully looked for, and, if possible, verified.

10. *Aster dumosus*, L. South-western Ontario (*Maclagan*) Dry thickets, Windsor, Ont. (*Macoun*) Vicinity of Hamilton, Ont. (*Logie*)

11. *Gnaphalium purpureum*, L. Abundant amongst grass at Port Colborne, Ont. (*Macoun*) Common about Victoria, B. C. (*Fletcher*)

12. *Silphium terebinthinaceum*, L., (Prairie Dock) Open woods and grassy banks, Cayuga and Amherstburgh, Ont. (*Maclagan*) Along the G. W. Railway, east of Paris, Ont. (*Prescott*)

13. *Artemisia caudata*, Mx. Half-way Island, Detroit River, Ont. (*Maclagan*) Gravel ridge, west of Fort Ellice, Manitoba (*Macoun*)

14. *Krigia amplexicaulis*, Nutt. Damp grassy thickets around Amherstburgh (*Macoun*) Islands in Detroit River (*Maclagan*) Near Lake Winnipeg (*Dr. Houghton*)

15. *Vaccinium stamineum*, L.. (Deerberry) Whirlpool below Niagara Falls (*Maclagan*) Dry rocks, Thousand Islands in St. Lawrence River (*Macoun*)

16. *Steironema lanceolatum*, Gr. Low grounds and thickets, Western Ontario (*Gray*) Pt. Abino, Lake Erie (*Day*) London, Ont. (*Burgess*)

17. *Acerates longifolia*, Ell. Sandy shore, Pt. Pelee (*Macoun*) Sand beach at Pt. Edward, Lake Huron, Ont. (*J. M. Macoun*)

18. *Hydrophyllum appendiculatum*, Mx. Abundant in thickets at Pt. Pelee (*Macoun*) Amherstburgh (*Maclagan*) London, Ont. (*Burgess and Saunders*)

19. *Lithospermum latifolium*, Mx. Open ground and borders of thickets, Western Ont. (*Gray*) Bois Blanc and other islands in Detroit River (*Maclagan*) Alluvial flats of Thames, London, Ont. (*Burgess*)

20. *Veronica Virginica*, L., (Culver's Physic) Moist woods and banks from Canada and the Winnipeg valley southward (*Gray*) Islands in Detroit River (*Maclagan*)

21. *Pycnanthemum incanum*, Mx. Dry soil, Canada (*Goldie*) New England to Western Canada (*Gray*) Hamilton, Ont. (*Logie*)

22. *Chamælirium Carolinianum*, Willd. Swamp near Brantford, Ont. (*Yates*) Canada (*Gray*) Niagara River (*Day*)

23. *Eriophorum lineatum*, Benth. & Hook. Pt. aux Pins (*Burgess*) Low ground at the southern end of Pt. Pelee (*Macoun and Burgess*) Gravelly river flat, London, Ont. (*Burgess and Millman*)

24. *Panicum scoparium*, Lam. Sandy woodlands, Pt. Pelee (*Burgess*) Pacific Coast (*Macoun*)

25. *Cenchrus tribuloides*, L. Port Colborne, Ont. (*McGill Coll. Herb.*) Pt. Pelee and Pt. aux Pins (*Burgess*) G. W. Railway, a mile east of Dundas (*Logie*)

26. *Muhlenbergia diffusa*, Schreb. Above the canal at Port Colborne, in grassy woodlands (*Macoun*) Pt. Pelee (*Burgess*) Hamilton, Ont. (*Buchan*)

SYNOPSIS OF A LECTURE ON POTTERY, PORCELAIN AND KERAMIC ART.

Delivered before the Hamilton Association, March, 1889.

BY. S. JOHN IRELAND,

Principal of the Hamilton Art and Technical School.

Introduction (*Ancient*)—Among the early nations of antiquity, before the art of writing had come into general use, tradition was the only mode of preserving and spreading a knowledge of remarkable events. Hieroglyphic writing followed, and from the hieroglyphs of ancient Egypt, in the most remote period of that country's history, we see reference to the potter's art. Later we have the picture writing on the vases of the old Greeks.

Many circumstances contributed to give the early traditions a fabulous character—the love of the marvellous, a natural tendency of the mind to employ symbolical and allegorical images to express ideas for which no definite words had been appropriated, and a disposition to eulogize and exaggerate the exploits of ancestors, all conspired to load history and fact with a mass of fiction, so that it became impossible for later enquirers to distinguish accurately between the true and false. One thing with regard to Egyptian art, not of Pottery only, but of every other section, we find it at the highest stage of development then known ; no incubative period, few gourd and vegetable shapes, for the potter's wheel was known ; not so with the Mexicans, the Hindoos and other races considered by ethnologists as belonging to the pre-historic period.

Introduction (*Modern*)—The singular interest displayed and excited in late years on the subject of pottery, is at this time bearing remarkable fruit, in the shape of a widespread effort to produce forms and surface decoration on forms that shall rival those done in such old times as are regarded as being peculiarly rich in artistic light and insight. The rivals of the ancient works are seen daily in increasing numbers, in varying beauty, and of diverse colors and characters. Scarcely a month passes now without some addition being made to the number of vases decorated by new methods, which take the im-

press of the individual minds that have invented them. We have thus had revivals in Majolica, Faience, Lustred-ware, etc., and with all we may say truly, that as examples of pottery, that is, more especially in the mechanical and material construction of the new wares, they greatly excel the old ones in perfect finish, durability and chemical composition of their parts, both in body and glaze. But this is not everything, and it is well known and seen that the ancient works and those of the Renaissance excel our own in their taste, artistic freedom and wealth of ideas. In these particulars we have much to do to equal, and still more to do to excel, these old world productions of the potter's art.

What Pottery is.—At the risk of saying what nearly all already know, I wish to make clear what pottery is. A pot is a vessel made of clay, and clay is that natural substance produced by the grinding and washing down into hollows, or places where it can settle, of many sorts of rocks, and as the rocks are of many qualities and consistencies, so are the clays. But to take a familiar example—the clay which I have in my hand if thrown on the potter's wheel, then made into a flower pot, for instance, and allowed to dry, would keep its form in every particular, except having shrunk by the evaporation of the moisture from the clay. This pot if exposed to the sun, in a hot climate, would have still more water drawn from it, and in consequence would become harder and closer in texture, and might be used for many indoor purposes, but would not allow of any use that involved the contact with water as it still would be a mere clay pot; if, however, it be put in the fire so that so much more of the water be driven out as will change its hardness to that of a tile or brick, then fluid might be put into it without any risk of its receding to the clay state, or crumbling into bits or flakes. When water has once been driven out of clay by the action of fire it remains a piece of pottery for ever. It is not, however, the mere expelling of the water from the clay which turns it into pottery, but the action of fire fuses some of the more readily fusible particles of the clay formation into an indissolvable homogeneous mass; but with most clays this ware is absorbent, a brick, for example, will suck up a pint of water and not dissolve.

A bit of clay, after firing, may be either white, yellow, red, grey, bluish, black, or any or all of these together—color being a condition solely due to the presence of other qualifying minerals or metals in the vicinity of the clay bed. For example—clay from an iron district

would be somewhat the color of iron chemically treated by natural causes, mostly by oxidation; or from the vicinity of springs containing sulphur, iron and copper, would be of a *greenish* tint; when these mix with cobalt, hæmatite or manganese, *black* is the result. In white clay, cobalt or black neutralizes and has the effect of whitening, as the blue does in the laundry. The white clays are found near silver beds, quartz, silicate of lime, felspar and oxides of tin and silver.

Terra Cotta.—Now our flower pot or piece of Terra Cotta has certain characteristics; it is somewhat brittle, porous, gives a dry, adhesive sensation to the tongue, is more or less gritty to the touch, and on the whole not a very useful thing for the higher purposes of civilized life. But for many ages the pottery was of this rough kind, as seen by the drawings, photographs and diagrams hung around the room to illustrate the lecture. It is very doubtful if the Greeks ever, or the Romans up to the time of Augustus, knew of any other kind of pottery. The next stage was to find out either a clay which would fuse, so as to be non-porous, or to coat a porous body with a non-porous coating of glaze (glaze simply meaning a film of glass) The former process, that of rendering the body impervious, applies mainly to two kinds of ware: 1st, *China*, or as it is sometimes called *Porcelain*, made from Kaolin clay; and 2nd, *Stoneware.*

It will be seen, therefore, that the potter's art is progressive. The "sun dried," gave place to "fired earthenware" or terra cotta, and this in turn gave place to "glazed earthenware," which was impervious to moisture, dirt and ordinary chemicals, including most acids, which practically means the ware was quite indestructible.

Antiquity of Glazed Ware.—Certainly the potters of Babylon knew the process of glazing, as the fragments of tiles still in existence show; but many centuries elapsed before the secret of manufacture was transmitted to the western world. Specimens of glazed pottery of decidedly moresque origin have been found in Spain, and could not have been later than the 9th century.

Glaze.—Glaze and glass are made out of the same materials. Flint, sand and soda, when fused together, make glass; the addition of a metallic oxide gives color, opacity and the better power of cohesion to glass; and these are precisely the conditions of glaze as applied to pottery. Some writers try to distinguish between "pottery" and

"porcelain" by the opaque body of the former, and the semi-translucent body of the latter; but as the history of both arts is so intimately blended and they naturally result from each other, we shall by noticing them together prevent confusion.

Origin of Porcelain.—This kind of ware was known in China B. C., but is believed to have been perfected about A. D. 1000. Marco Polo describes it, in the 14th century, but it was only generally introduced into Europe by the Portugeese, in the beginning of the 16th century, who called it *porcellana*, meaning "little pig." This name had been given to the cowrie shell from the similarity of its shape to the back of a little pig, hence when they saw this remarkable pottery of white color, glazed like the surface of shells, they gave it the same name, with the idea of conveying to their countrymen some notion of its beauty, or possibly from a persuasion that it was made from such shells, but in fact from Kaolin.

Kaolin.—Kaolin, or, as it is called in England, china or Cornish clay, is the result of the natural decomposition of granitic rocks. When used alone it is opaque, but is made translucent by the addition of "petrunse" or "china-stone," containing much unchanged felspar, known as "flux"; the felspar in the Kaolin having lost its alkali and become converted into earth. It is somewhat curious to observe that all the old potteries were in close proximity to rivers, and to rivers more or less subject to periodical inundations—for example, the Nile, the Euphrates, the rivers of Italy and Greece, and even the Thames and Seine. Countless theories have been propounded and hundreds of volumes written respecting the discoveries of pottery, but it is only when we review a collection such as is in the Historical Museum of fictile productions at Sevres, that an analysis of known stages and gradations, affords a basis for a sound theory respecting those early steps of advancement, concerning which we can obtain little or no information in a definite form, and for which we must to a great extent rely on conjectural evidence. The collection of Greek and Etruscan vases in the British Museum, London, is not only a history of these countries through their glorious epochs, but actual scenes are depicted, which to the modern scholar are classified in the world of myth.

Ancient Vases.—The names of ancient vases, according to Gerhard, were next given, and their forms and uses explained from

drawings, diagrams and photographs. Reference was also made regarding the value of the study of pottery, to the economist, the chymist, the historian and the ethnologist.

The earliest specimens of prehistoric pottery, in shape, resemble vegetable forms—for example, the gourd, the pitcher plant and the acorn cup, also bulbous plants—so much so, that from some specimens of pottery which have stood the ravages of time, we can trace some aboriginal plant forms. The diagrams of prehistoric pottery were then explained, particular attention being called to the Pueblan and Mexican as being a connecting link between earthenware and stoneware. An animal form, which was either a toy whistle, or one used as a signal in times of war was specially commented on. Certainly this instrument, which is the property of Mr. Kennedy, produces a volume of penetrating sound quite out of proportion to its size, and would probably be heard two miles distant.

A diagram showing the potter's wheel and kiln was then shown, such as was used by the Egyptians nearly 3000 years B. C., taken from the sculpture on the tomb of Beni Hassan. It would seem that however universal the production of vessels of baked clay (terra cotta) the art of applying to them a vitrous covering was an invention which emanated from the East; Egypt, Assyria or Babylonia glazes being of two kinds, "Silicious" or glass glaze, and "Plumbaceous" or lead glaze. The use of tin for a white enamel, as recently discovered in the enamelled bricks and vases of Babylonia and Assyria, anticipated by many centuries the rediscovery of that process in Europe during the 15th century, and shows the early application of metallic oxides, which for centuries was the secret of the East only.

Egyptian.—In Egypt and Assyria, enamelling is frequently more used than glazing, and their works are a kind of "faience," consisting of a loose frit or body to which an enamel adheres, after only a slight fusion. Specimens of enamel turquoise, never before or since equalled, have been found in the tombs of Egypt, but only on small articles which could be used as jewellery.

Grecian.—Greek wares are characterized by perfect form, such as modern potters would give all their worldly possessions to even reproduce. They may have been glazed with a thin coating of aluminous soda-glass (without any trace of lead in its composition)

the greater part of which was absorbed into the substance of the "piece," thereby increasing its hardness and leaving only a faint polish on the surface of the ware.

Slip or Engobe.—Pesseri instances the use of glaze on tiles upon a tomb in Bologna, opposite San Domenico, dated about 1100, and further states—but it is not known on what authority—that it was about the year 1300 that the method of covering clay with a "slip" or "engobe" of pipe clay on the coarser earth of Verona was first adopted.

Glaze.—Slightly baked it was glazed with "Marzo Cotto" (oxide of lead and glass) applied wet, and then fired; this glaze was variously colored, yellow, green, black and blue by antimony, iron, manganese and cobalt. A similar method of glazing seems to have been known in Germany, England and France from a remote period, but was not in general use.

Tin Glaze.—It was found by the addition of a certain portion of oxide of tin, to the composition of glass and oxide of lead, that the character of the glaze entirely alters, and instead of being translucent it becomes, on fusion, an opaque and beautifully white enamel (the intervening process of covering the coarse clay with a stratum of white earth being unnecessary) it moreover was found to afford a better ground for the application of ornament. The process of application was the same as for slip. After immersion in the enamel bath and subsequent drying, the painting is applied on the absorbent surface, the piece being then subjected to the fire, which at one application fixes the colors and liquefies the glaze. This enamelled pottery is by far the most important group of glazed wares, being susceptible of decoration by the lustre pigments, as well as by painting in colors, with great delicacy; it comprises the "Hispano-Moresque," the "real Majolica" and the perfected earthenware of Italy and other countries.

Lustres.—The earliest traces of the use of Stanniferous enamel glaze in Europe known to us, is always in connection with a decoration produced by the reduction of certain metallic salts in the reverbatory furnace, leaving a thin film on the surface and giving the beautifully rich effect, known as "reflet metallique," "nacrecangienté," "Rubino," "Reverberato," and, in England, as "lustred wares." In Italy the use of metallic lustres was apparently known and

practised previous to the introduction of the tin enamel, for we have abundant examples of mezza-majolica from the potteries of Pessaro or Gubbio, glazed only with oxide of lead and glass, which are brilliantly lustred with the metallic colors. None of these can, however, be referred to an earlier date than the latter half of the fifteenth century, when taken from Italian records, which means with us the sixteenth century. The Italians appear to have learned the art from the Moorish potters of Majorca, and named their ware after that island. This seems a reasonable conclusion. Many countries claim the honor of inventing the tin enamel glaze; it undoubtedly came from the East, but Succa della Robia, born 1400, was the first to execute it on a large scale in Europe, hence its name; the secret was kept for two succeeding generations.

Gubbio Ware.—"Gubbio ware" is of the same nature, but different in glaze. Gubbio is a small town in the territory of the Dukes of Urbino and is one of the most famous in the art of pottery. This excellence is chiefly attributed to the talent of one man, Maestro Georgio Andreoli, under whose direction the works at Gubbio produced examples of a special nature. The pieces were decorated with lustre pigments; flashing, brilliant, metallic, ruby, golden and opalescent tints, which vary in every specimen, as they reflect the light directed at varying angles upon the surface.

Faience.—The choicest works of Italian pottery were produced between the years 1480 and 1530. Some of the productions at this time actually bring their weight in gold, and they were not made as thin—far from it—as a specimen of "eggshell." The various names by which the Italian pottery of the "Renaissance" has been known, have in some instances arisen from the names of the places of manufacture, but this fact is often misleading—for example, "Fayenza ware" doubtless derived its appellation from the town of that name, although in French the equivalent "faience" may be either a translation of the Italian or may be derived from a town near Cannes called Fayence.

A description of the Italian "gift pieces" was then given, which cannot be well rendered without the aid of expensive wood cuts or chromo lithographs, and so is omitted.

As no lecture on pottery would be complete without reference to

the prince of potters, Bernard Pallisy, a short biography of this illustrious man was read and reference made to his struggles and the present prices of his wares; only a few months since a small salt cellar being sold for $1,010.

French Ware.—The "Oiron" or "Henri Deux" ware is the most chaste of any yet made; there are but 86 known pieces, and each is worth $5,000—present prices. Very marvellous works in Porcelain, especially flowers and bouquets, were made early in the 17th century at Vincennes, under the patronage of Louis XV. An amusing incident which occurred, at the residence of Madame de Pompadour, with these porcelain flowers was given, showing how perfect was the imitation, even to their being perfumed.

English Potters.—The English potteries were next briefly described. The first earthenware made after the time of Josiah Spode was far from being so good as that at present produced, and several attempts were made to bring out pottery which should be intermediate between earthenware and porcelain. The most successful was that made by Mr. Mason, at Fenton, who, in 1813, took out a patent for "ironstone-china," the body of which was fluxed by the scoriæ of ironstone and the ordinary Cornish stone, but eventually the latter was found sufficient for the purpose. The name "ironstone" remained attached to that class of pottery, which is strong and resistive, but since then earthware has so much improved that *ironstone* has gone out of fashion. The nearest approach to this ware is the *white granite* made for the Canadian and American markets. This ware is richly glazed, is thick, and is manufactured to compete with the French hard porcelain. About fifty manufacturers are specially engaged in making it, and those worked by Messrs. Powel, Meakin, Shaw, Bishop and G. Jones may be considered the largest. It is a curious state of things that the best earthenware is still made for the English home market, while as yet but small quantities of it have been in demand in Canada, the other British colonies and the United States. This statement was made in 1877 by Monsieur Arnoux, the chief director of Messrs. Minton's works at Stoke on Trent. At the present time some of the English ware is so perfect that if it were not opaque it might be mistaken for porcelain, when richly decorarated and gilt like that by Messrs. Minton, Wedgwood, Copeland, Furnival, and Brown-Westhead. To give some idea of the extent of the potteries the lecturer said that Messrs. Minton alone employ two

thousand hands, and have about thirty kilns in blast ; in fact in ten square miles in the pottery district one hundred and eighty-five thousand people are employed.

Perhaps the climax of the potter's art may be said to have been reached in Messrs. Doultons' "salt glaze coils" for chemical works, and their ornamental earthen and stoneware. The latter is made from a clay or frit which fuses at white heat, and when the kiln is at this stage a large quantity of common salt is thrown in at the top, which immediately vaporizes and chemically reacts on the surface of the ware, which, on being cooled, presents a perfect glaze; the finest scratches are not filled up, and yet the ware will withstand the action of most acids. Messrs. Doulton, from the first, saw the value of not only making good ware, but that it was necessary to have good artistic decoration on pottery to ensure its demand by the public. They founded the Lambeth Art School expressly to train designers for their works, and engaged the services of Mr. J. Sparkes, the worthy Head Master of South Kensington Art School, to superintend and direct the labors of their staff of already well-trained artists.

The subject of pottery is such a vast one that it is impossible, Mr. Ireland said, to treat of it in a popular way, or to do justice to it in a couple of hours, and mentioned for those who wished to pursue the study, that "Chaffer's Marks on Pottery and Porcelain" was a reliable work for collectors, while "Marryatt's History of Pottery," "Hamilton's Greek and Etruscan vases," "Dennis' cities and cemeteries of Greece and Etruria," should also be read. To enter into the different means of producing colors would more than fill a paper by itself.

Ludwig Ritter, a modern, celebrated writer says: "It is no very easy thing to make intelligible to those who have no love for pottery, who take no delight in the curious and beautiful pieces of china and earthenware, how it is that very many of their fellow mortals, not altogether despicable persons, are possessed of an enthusiastic liking for these things. The truth is that the prevailing love for old china is both deep and wide to the antiquary and to the student of past history. There is this attraction in the Keramic art, that its productions more perfectly adapt themselves to the fashion of thought, to the fancies and ideas of each successive generation of men, than those of any other human industry."

About one hundred specimens of pottery—some of them very valuable—had been loaned by Messrs. J. A. Skinner & Co., A. T. Wood, Esq., and the lecturer, who described when and where each typical specimen was made and how decorated. Several specimens were shown, illustrating an absence of true taste, both on the part of the producer and purchaser—for example, a jug in the form of a fish—who could drink water from the stomach of such a monster without fancying there might be either a nauseous taste or smell with it? Also a pitcher made like a wicker basket—whattle work has its use, but is out of keeping when made of brittle pottery, and pottery, too, to hold fluid.

The process of printing on pottery was then minutely described, also painting over and under glaze, gilding and burnishing, sgraffitto, etc.

The most interesting part of the lecture has, of necessity, to be omitted from this abstract, as it would be unintelligible without chromolithographic illustrations.

NOTES ON THE ORIGN OF CHERT (FLINT) IN THE LOCAL NIAGARA ROCK,

BY COLONEL GRANT.

Read before the Hamilton Association, 9th May, 1889.

I confess I am unable to accept a belief entertained by some members of our Association as well as others also, viz.: that our local "chert" on the brow of the escarpment here was derived from the great number of sponges found in this "band."

Sponges of the Hexactinellid type doubtlessly possessed the power of secreting the silex held in solution in the Primeval Sea to build up what we may call the "skeleton," but it seems quite impossible that a soft, jelly-like organic substance can, *of itself*, produce the hard, flinty matter in our "Macadamizing band" (12 feet in thickness at the head of the Jolley Cut, but eight feet of the upper part was ground down and removed in the "Great Ice Age")

All decaying animal matter appears to me to have possessed the same property of attracting to itself, during the deposition of "the chert band," *silex in solution*. There is scarcely a fossil found in the lower Niagara limestones which does not present a stunted representative of a like individual enveloped in cherty matter. "Stricklandinia" (Billings) and "Pentamerus" may be named as exceptions, flourishing, probably, at a certain depth of water on or contiguous to "Coral Reefs."

I wish to call particular attention to an Echinus of the English chalk (in one of your cases) presented to the Museum by your Curator, Mr. Gaviller, for I think even a hurried examination of this interesting specimen may impress on the memory facts which no words can so clearly convey.

In this "Sea Urchin" we find the entire interior filled with hard flint (chert is merely an impure member of the same family) and since the outer crust is preserved (although the spines are absent, as they usually are now in dead ones) is it not evident that, *the silex filling the interior could only have entered by the minute apertures in a soluble state?* I may be permitted to call attention to remarks made

by Sir Wm. Dawson, in chapter 1, pages 14 and 15, of a recent work, "The Chain of Life," on mineralization by the process of infiltration. The conditions assumed by a Clinton "Farosites" here, is precisely that of the tabulated coral represented in figure 2, when the wall is silicified and the cells filled with silica. It seems more difficult to understand why the spiral coils of some of "the Silurian" and "Carboniferous" Brachiopods, "Spirifera," "Atrypa," etc., are so beautifully displayed in a silicified condition, while the remainder of the interior of the shell is often perfectly hollow.

The Director-General of The Ohio State Survey (Dr. Newberry) mentions a very remarkable instance where a modern plant (or lichen) had stamped its impression on a quartz (silex) pebble by dissolving the flinty material with which it came in contact. The following paragraph occurs, page 111., vol. XI., "Proceedings of The Ohio Survey:" "Some years since, at a meeting of The American Association, the Geologists present were much puzzled by some specimens of the Conglomerate (carboniferous) exhibited by Prof. Brainerd, of Cleveland, in which the impressions of the stems of plants were as distinctly transmitted to the quartz pebbles as to the interspaces of sand."

Prof. Brainerd argued from these specimens that the pebbles were of concretionary origin, and that they bore the marking of the bark of plants because they had been formed in contact with such bark. The recent experiments of THENARD which show that numic acid renders silica readily soluble, afford an easy solution of the problem, and confirm the view taken by the writer upon the occasion referred to above, viz ; "that the pebbles had been dissolved away where in contact with the plant." Here we have apparently a well authenticated instance of a modern plant possessing an acid sufficiently strong in its *natural state* to corrode and eat its way into "the quartz." Professor Sollas, now of Trinity College, Dublin, some years ago, pointed out how the silica of sponges was rendered easily soluble and often replaced by "calcite." Unfortunately, I cannot find the paper, which has been mislaid or lost. I am quite satisfied that such is the case. The impure limestones of "The Burton Niagaras" which overlie "the chert band," frequently display a mere outline of the form of *a sponge*, which had disappeared and been replaced by a softer mineral.

On the left bank of the Thames River, near Komoka, I noticed a spring in a wood close to the stream holding silica in solution. There were some fresh-looking chips of hardwood lying at the bottom, and, on fishing them out, I found they were silicified. This spring arises from "Corniferous drift." I cannot say whether it has a deeper origin. "The drift" itself contains a good many white sandstone boulders. So, acidulated waters, percolating through it may carry off a certain portion of the silex overlying.

Origin of Chert or Flint.—In my younger days the view entertained by geologists, respecting the origin of the flint in the English Chalk, was, that it was derived from mineralized heated springs at the bottom of the "Primeval Seas"—there were few found hardy enough to dispute what was almost universally supposed. Now, as I never had an opportunity of examining "the English chert of the chalk in situ," I can form no opinion with regard to it, but I may say I have failed to obtain any evidence whatever of "Thermal Springs" arising from the sea bottom, when our local chert band was deposited. And I would venture to remark it was more probable that the silica was originally derived from acidulated water carrying down the matter from "*The Laurentian Highlands*," quartzites and the granitic rocks which formed the northern boundary of this Silurian (Mediterranean) Sea. That this continent possessed such, is admitted by leading geologists in Canada and the States. It is well known that the succeeding rocks of the "Devonian" and "Carboniferous Ages" also contain a large amount of cherty limestone. A striking characteristic of these and some other limestones of the "coal measures," remarks Dr. Newberry, is the quantity of silex they hold locally. The Zoar limestone becomes so cherty as to be called flint or burr-stone. In other portions of the coal field the higher beds exhibit the same phenomena.

The origin of the silex in these flinty limestones, he adds, has never been satisfactorily explained. It has sometimes been attributed to hot springs, of which the water contained much silica, but the general distribution of the flint and the number of fossils contained in it, seem to me insurmountable objections to this view. It is more probable that the silica was derived from microscopic organisms, such as the "diatoms." It seems to me quite possible the individual forms have disappeared by solution, and that the moss has been converted into compact silica, such as we find in "chert beds."

I agree with Dr. Newberry, that, if the chert had been furnished by hot springs, we must find it accumulated around the source of supply—but we discover nothing of the kind.

Admitting that diatoms are soluble and may be consolidated in the manner described, I doubt very much if this explanation can be deemed satisfactory. It fails to meet many objections that could readily be made, I think.

In a recent communication from a friend of mine in Chicago, who has already named three new genera of Hamilton sponges (not yet described) he mentions that he had obtained, in Tennessee, recently, about twenty specimens of sponges very similar to the ones discovered here from the same geological horizon, but fossilized in an entirely different condition. It is probable the sea near the "Laurentian Hills" contained more silica than the same water so far south.

The absence of Niagara chert was very noticeable in the Island of Anticosti. Although I obtained a very large number of fossils, there was not a sponge among them.

I do not think either the "Clinton" or "Medina" rocks are represented there (although a few fossils of the series may occur in the limestones) These beds, perhaps, were confined to the inland sea. The rocks at Anticosti were deposited under different conditions, in an open sea.

NOTE.—Since the above was written, I find from a paper published by Sir Wm. Dawson, in the "*Quarterly Journal of the Geological Society*," for Nov., 1888 (a copy of which he kindly sent me) that he holds the same opinion as the late Mr. Billings, viz: that the Clinton rocks are represented by limestones underlying the Niagara beds in Anticosti.

This view, perhaps, may have originated in the discovery of similar fossils, which I failed to obtain. Fossils, however, are scarcely safe guides there,—they are so mixed up. For instance,—*Graptolithus Clintonensis*, a characteristic Clinton Graptolite elsewhere, is found well up in the Niagaras there, near the S. W. Point Lighthouse.

NOTES ON COLORED LINGULÆ—SILURIAN.

Read before the Hamilton Association, 9th May, 1889.

BY COLONEL GRANT.

Among the oldest forms of "organic life," known both in Europe and this continent, are the brachiopods called "Lingulæ" or "tongue shells."

Found in rocks from "The Lower Cambrians"—inclusive—upwards, partaking both of the nature of a "Mollusc" and "Annelid," surviving all changes, their fossilized remains present to the chemist the same phosphatic constituents as the modern shell when subjected to chemical analysis.

There has been no *advance*, and seemingly no *degradation* since they first appeared in the "Primeval Seas"—a remarkable fact, as the family approaches, in modern times, probably, extinction. Any one who has examined the valves of a modern Lingula (L. Anatina of the Philippines, for instance) must be struck with the close resemblance this Phosphatic Brachiopod bears to its fossil predecessors of our local Silurian. This, and a different species (said to be brought from Carolina) are the only ones I have ever seen, although others, perhaps, are known to conchologists.

"Observations," remarks the author of Manual of the Mollusca "are much wanted on the living Lingulæ. The oral arms, probably, extended as far as the margin of the shell. The pedicle is often 9 inches long in preserved specimens, and is doubtless much longer and contractile when alive. The shell is horny, flexible, always of a GREENISH color. The recent species," he adds, "have been found at small depths, even low water, half buried in sand."

As far as I know the Silurian Lingulæ of Hamilton are *the oldest colored shells* yet discovered.

The British Museum possesses a colored Nerite of the "Devonian age," and the late W. H. Baily, Palæontologist to the Irish Geological Survey, informed me several years ago that they had just obtained some Fossil Ferns (Carboniferous) which retained

a portion of their original color, and a beautiful Aviculapecten, with wavy lines, deep umber, from the "Mountain limestone," Ireland.

The best preserved specimens of the Lingulæ here are found at the bluff or cliffs a little beyond the "Reservoir." They occur in a large flag near the summit, "upper red band." The flag in question is about 4½ inches thick, and, on splitting, it presents a ripple or "wave mark" in the interior, clearly proving its deposit in very shallow water.

Casts of the detached valves of other shells (undescribed) "Modiolopsis," "Posidonia" and "Avicula," are frequently obtained associated with the Lingulæ. An Eichwaldia valve (unusually large as compared with one in the "chert beds") was also noticed.

Casts of the single valves of "Lingula Oblonga" (color blue) are very numerous. "Lingula Oblata" (pink) is rare, and "Lingula Perorata" (brown shading to blue at the beak) rarer still. All, however, occur on the inside of the slab, occasionally *close together*. They represent casts of detached valves of dead shells washed up and heaped together by the waves. Only in a few instances I noticed both valves complete, and twice I found "Lingula Oblonga" fossilized seemingly in its burrow. The question arises: do the shells possess any portion of the *original* coloring matter, or is the difference of color now seen due to the influence of chemical agents? On this point some Palæontologists differ, while others hesitate to commit themselves to any opinion on the subject. Now granting that recent Lingulæ are green—may not such be the survivors of a family group that at one period of its existence was represented by other species quite different in color? This seems worth investigation. The Common Mussel (Mytilus Edulis) of the North Atlantic is blue; Mytilus Smaragdinus (Ceylon) is green; Patella Vulgata (British Seas) is colorless; while the Patella of the Adriatic is deep blue.

The colored Lingulæ are not altogether confined to a single horizon. In a few instances I found "Lingula Oblonga" retaining a portion of blue coloring matter in an impure limestone near the base of "the Clinton," and also in "the sand beds" capping the series.

A lingula (L. lamellosa) probably, from "the blue building beds," Niagara limestone, also retains part, at least, of what I am inclined to think was the original color of the Brachiopod. In "the

Iron band" (Clinton) close to and above the "Upper Reservoir," we find "a Lingula" which Sir Wm. Dawson thinks may be a variety of "Lingula Oblata." It differs from the latter, chiefly, in being abruptly bent near the extremity of the posterior margin. At first I imagined it was distorted by pressure, but I now think this view erroneous, as the peculiarity has been remarked in several specimens from *different* beds. Another small Lingula from the same horizon and locality, displays "brown spots on a white surface," the beak being rather like that of "Lingula Cuneata" (Conrad) It may be asked, have we reason to suppose that colored fossils may yet be discovered in older rocks than our local ones here. I think they will be found in the "*Cambro-Silurians*," for in a "Hudson River" drift pebble at Burlington Beach I noticed a fragment of a *crimson* Lingula, while several years ago another fragment was obtained at Anticosti corresponding in color. I recollect extracting from a rock on the north shore of that island "a Pleurotomaria," retaining its nacreous lustre precisely like a fragment of an Ammonite (Am. biplex) in my possession, which was obtained from the upper Oolite Kimmeridge clay, England. I know the belief is usually accepted that Tropical shells owe (as a general rule) their greater brilliancy to the sun's influence in the regions they inhabit—"that the mantle of the shell possesses the power of decomposing light and of secreting or appropriating color." This may be true enough, however, in the case of "Ianthina fragilis" (the Violet Sea-snail) many naturalists, who have closely studied the subject, stating that the shell's color is derived from "*the blue Velella*" it feeds upon. If this fact was clearly established it would be but natural to suppose that it is not the only Mollusc which is indebted to the plants or minute creatures which they live upon for at least *a portion* of their brilliant hues. Dealers, for instance, can discriminate between "the natives" (green oysters feeding on "Confervæ" in artificial parks) and the same bivalves from the natural oyster-beds, by the shells themselves. With reference to the colored shells of the later Palæozoic Rocks, I find at page 410 Boston Edition "Lyell's Elementary Geology" the following remarks under the head "Mountain Limestone" :—

"The mere fact that shells of such high antiquity should have "preserved the pattern of their coloring is striking and unexpected; "but Professor Forbes has deduced from it important geological

"conclusions. He infers that the depth of the Primeval Seas in "which the Mountain Limestone was formed, did not exceed fifty "fathoms. To this opinion he is led by observing that in the exist- "ing seas, "The Testacea," which have colors and well defined "patterns, rarely inhabit greater depths than fifty fathoms, and the "greater number are found where there is most light in very shallow "water, not more than two fathoms deep."

There are even examples in the British Seas—"Testacea" are always white or colorless when taken from below one hundred fathoms, yet individuals of the same species if taken from shallow zones are vividly striped or "banded."

"Lingula Ingrus" of the Niagara limestones, described and figured by Dr. Spencer, is black or horny in the only three specimens collected. Strictly speaking it belongs to the "chert beds." Now, as a general rule, the fossils of these beds present a *dwarfed* appearance like many contained in shales, even the Trilobites being quite stunted in growth. We know when the chert was deposited, there was an unusual quantity of silex held in solution in the water, and this or heated springs, derived from the Laurentian Highlands, may have exercised much the same unhealthy influence as the brackish water of the Baltic of our own day does on its inhabitants. The late lamented Dr. Carpenter examined many of the specimens brought to light by the deep sea explorations of the recent Challenger Expedition. Live specimens, he remarks, were obtained from depths verging on three miles; the result was to show that, while there is no depth at which animal life cannot exist, the deeper you go, the more scanty such life becomes. Temperature has a great deal more to do with animal life than the pressure of water resulting from depth of the sea, and, while in the cold underflow the same forms of life are found as elsewhere, the specimens are *greatly dwarfed.*

It seems a little singular that such a large Lingula as "Lingens" should make its appearance during the deposition of "the chert," and that one of the most minute members of the same family occurs in a true limestone layer here. It may be imagined that the latter is merely the young of a more fully developed Lingula, but as it seems confined to certain beds and has apparently no larger one associated with it, scattered as it is through three or four distinct layers of con-

siderable thickness, we may infer that it was a minute form fully developed and not a young shell.

The ravine below the "Albion Mills" is another locality near Hamilton to which I would call attention. I have not been there for many years, but the Lingulæ are of much interest. In many instances the thin outer valves are retained, but they are white or colorless, even in layers corresponding in position with the colored Lingulæ beds near the Reservoir.

The Burton shales resting on the chert beds here (although very fossiliferous) hold few specimens of Phosphatic shells. The Lingulæ (three species) are in good preservation, usually retaining both valves, which are black or horny. They appear to be confined to the lower beds; however, only in a few places are the upper ones exposed, so it is possible they may have hitherto escaped detection.

I am unable to state what induced Professor Morse, during the course of his experiments, to arrive at the conclusion that the living Lingula was a "specialized worm." It may seem perfectly natural to an evolutionist for an Annelid that found itself exposed to the attacks of enemies in the rear to evolve some shelly protection for the part exposed. Perhaps, in the words of Voltaire, "the first step was the only difficulty." A friend of mine suggested a different solution, but I doubt whether it can be seriously entertained by any naturalist, viz.: that the worm may have accidentally introduced the extreme end of its tail into the open valves of the Mollusc, and that the latter indignantly resented the intrusion by closing the doors of its habitation on its unwelcome visitor, and then, to use the words of "Ingoldsby," slightly altered—

> "In vain did it strain every muscle—
> The valves held it fast
> From that hour 'til the last—
> It could never get rid of its comfortless bustle."

How the Mollusc or worm transmitted to its posterity the marked characteristics of both combined I am unable to say. In the larval stage, Lingula, it is said, closely resemble the larva of an Annelid; this two-fold nature of early organisms has frequently been noticed by naturalists.

The mystery of life, however, remains an unsolved problem to

science. No satisfactory evidence has ever been adduced to show that dead matter of itself can give birth to living organisms.

As regards the fossilized remains now before us, which were embedded in the sediment of ancient seas—that they existed as living things can scarcely be disputed. In the words of a recent writer:

"Once they were not,
And now they are not,
And this is the sum we know."

BRIEF NOTES ON THE LAND AND FRESH WATER SHELLS OF THIS DISTRICT, SUPPLEMENTED BY GENERAL NOTES ON CONCHOLOGY, GATHERED FROM DIFFERENT SOURCES,

Read before the Biological Section of the Hamilton Association, April 5th, 1889.

BY A. W. HANHAM.

Little more than a year ago I received a letter from England from one greatly interested in Land and Fresh Water Shells, asking me to keep any that might come in my way, the writer being anxious to secure representatives from this part of the world. I wrote back that I would do the best I could, but remarked at the same time, that I did not expect to get a great variety, and, that the shells, alluding especially to the land shells, would not compare in size and beauty with some species that were common in England. These remarks showed how little I really knew about the shells which were to be taken here I do not profess to know much more now. No land shells yet found by me here will compare with English species in markings or bright colours, but a few walks abroad soon brought to light things not noticed before during a residence of some seven years in Canada, and, seeing that during all these years I have been exploring the woods and country in general in search of Entomological specimens, it goes to show how blind it is possible to be.

In taking up anything new I find it is absolutely necessary to find the eyes, so to speak, before the eyes are in a fit state to aid one in the study or undertaking. To make more clear my meaning;—for various reasons of late years I have confined my collecting almost entirely to the Coleoptera; now a large proportion of beetles are found only on or in the soil, under leaves, logs and debris, and as far as I can now see, the best spots or localities for these beetles are also the best for many species of land shells, but, till lately, I never used to see the shells. This remark applies also to aquatic species.

Conchology has its advantages over Entomology; for instance,

you turn over a log for specimens, and, unless the air is frosty, every live thing present, that has legs or wings, uses them to seek safer quarters—some are sure to get away—but any shells, dead or alive, may be gathered without any unseemly haste and speedily transferred to bottle or box. Of course, it is possible to overlook some, which often agree exactly in colour with their surroundings, and which, if they did move, would be easily seen. Others, again, are easily overlooked owing to their small size and a habit they have of hiding away in the crevices of logs, or in any inequalities that may be present.

Land shells inhabit nearly every country of the globe. They are found in woods, gardens, and hedges—the last named unfortunately conspicuous by their absence here;—I speak from a Conchologist's point of view, for they make splendid retreats for snails.

Where they take up their abode in the hollows of trees and stumps, under bark, in crevices of rocks, under stones, amongst moss, nettles or other weeds, especially in damp places, or adhere to boughs and leaves of trees, shrubs, &c., it is during the day that they retire to these situations, and in the evening they are to be met with crawling about; also sometimes during the day when the weather is moist and rainy.

Fresh water shells are to be met with in almost every lake, pond, river and stream, either lurking in the mud at the bottom, or feeding on leaves of aquatic plants, or along the shores or banks. Some species, which burrow deep in the mud, as Anodonta and Melantho, have to be dredged for, and others may be found by raking along the surface of the sand and mud at the bottom of ditches and ponds. Shells can only be expected perfect when they are got with the animal in them. Fine specimens of water shells may be found on the beach, or shores of our lakes, after a storm, but should they be thrown up out of the reach of the water, they are exposed to the continued heat of the sun, by which their colours become faded. A large proportion of the shells seen in collections have been picked up on the beach, and are seldom very perfect, being either worn or broken. River and land shells are mostly thinner than those of the sea, though there are exceptions to this rule. Some land shells are very beautifully coloured or marked, and elegant in their form, especially those found in tropical climates. In Africa they

grow to an amazing size, and would be very unwelcome guests in our flower and kitchen gardens, as they commit great havoc among the esculent plants. You will better realize this fact when I state that one species, Archatina Zebra, is very frequently found measuring seven inches from apex to base of shell.

When shells are found with the animal alive in them, boiling water should be poured upon them. The animal may then be easily taken from bivalves, but caution is required with the univalves, as should part of it be left in the volutions, it will be almost impossible to extract it, and to prevent the shell from becoming offensive it would be necessary to leave it for a considerable time in alcohol, where too long an immersion might change the colour of the shell somewhat. I have also heard the use of salt mentioned as a means for killing the occupants of land shells, but have not tried the process myself. Shells of any size should be oiled, not varnished, to preserve the natural color and to keep the epidermis from cracking. Worn and old shells may be restored almost to their original beauty by this means.

The Rev. Geo. W. Taylor, now of Billings Bridge, near Ottawa, lately of Victoria, B. C., has very kindly named all the shells I took last season, and some I have already added to my list this year. Mr. Taylor is also an Entomologist of some standing. In one of his letters to me, he says:—"I have collected for some years on the "Pacific Coast, and am now collecting here, so that your shells from "an intermediate station are very interesting to me. The number "of Canadian land and fresh water shells known to me is as follows: "fresh-water bivalves, 72 species; fresh-water univalves (operculate) "13 species (non-operculate) 45 species; land shells, 82 species—total "212. No doubt many additions will yet be made, and your posi-"tion is an especially favorable one." In another letter he remarks: "your collection is interesting, but I notice it is deficient in the "small land shells. Look carefully under leaves, amongst ruins, in "woods and under logs everywhere, and you will find lots of treas-"ures. Take a long series of fresh water shells from every piece of "water you come to, and I have no doubt you will add to the Can-"adian list." Again he says:—"land shells can be named without "much trouble, but fresh water shells are much more difficult to deter-

"mine, as they run one into another to an alarming extent, the "generas Linnæa and Physa being especially so."

Since I received these letters I have taken six or eight species of these small land shells, to which he referred; and, as you can see, there is no doubt about some of them being decidedly tiny. One species, Pomatiopsis lapidaria, is new to the Canadian list, but is common in some localities in the United States.

Through the kindness of Mr. and Mrs. Billings, of this City, I have come into possession of a small collection of land shells from Jamaica. They are from the cabinet of Mr. Wm. Roy, a resident of that island. If such large and strikingly beautiful and graceful species were to be found about Hamilton, there would certainly be more excitement in the actual collecting than there is now.

The Report of the Conchological Branch of the Ottawa Field Naturalists' Club for 1883-4, gives over 100 species taken in that district, and no doubt that number has heen considerably increased since then. Mr. Latchford, in an able paper, read at one of their soirees, gave descriptive notes of 27 species of the Unionidæ. I have taken only 7 species here as yet, but see no reason why this district should not be as rich as the Ottawa when properly worked, and I think we should exceed them in the number of land shells.

The Report of the Geological Survey of Alabama for 1876 contains a list of the shells of that State:—land shells, 76 species—fresh water, 612 species—total 688. This list shows the amazing number of 263 different species of Unionidæ, and 155 species of Goniobasis; of the latter I have but a single representative.

Numbers of our fresh water shells when in good condition, chiefly among the Unionidæ, attain a large size, and some are very handsome. Referring to the Unionidæ, the late Dr. Isaac Lea, who studied this order for fifty years, computed that a large specimen of Unio Multiplicatus contained upwards of three million embryonic young. Of course nearly all these perish early, being devoured by fishes, crustaceans and the larvæ of insects, few attaining maturity, which is reached in from six to ten years. The young of Unionidæ are for a time provided with hooks, by which they can attach themselves to contiguous objects, as for instance a fish or a water bird, being in this way transported to great distances. I

have seen it stated that some land shells are so minute that a good glass is necessary to see them at all;—I draw the line at these. Such forms are to be found in and under moss on rocks and shady hillsides, under dead leaves and loose bark on old stumps, and under and in decaying wood, stumps and logs. It is especially during late autumn, and in open weather in winter and early spring that these little species can be found in great numbers in their winter quarters. Dr. Sterki, of New Philadelphia, Ohio, writes:—"It may not be "generally known that many small land shells are fond of "animal matter for food; the fact that they have been found "accidentally in considerable numbers in skulls, &c., makes it "advisable to place large pieces of bone with open cavities, "such as the head of a sheep, in suitable localities, well "secured by heavy stones or logs against rapacious animals, "thus forming traps as it were, to be visited from time to time, "for the small Hyalinas, Pupas, &c., living upon and in them. "Pieces of wood covered with lard will answer the same purpose. "In collecting shells never fail to look for them under plants with "broad or numerous leaves spread on the ground and about the "roots. A few weeks since upon a single stalk of Iris, standing "on a dry, gravelly bank, I collected in half an hour more than 200 "Pupa Armifera, besides specimens of 5 other species. Many "small species, living in moist places, have to be looked for along "the very edge of waterways of all kinds; some of them like to "ascend reed grass, &c."

In Woodward's Manual mention is made of a snail which got entángled in a nutshell when young, and the shell growing too large for it to escape, it had to endure the encumbrance to the end of its days.

Mr. John Ford, of Philadelphia, writes that:—"Certain fresh "water species will live for months without food or even water, while "many species of Helix will endure the same apparent hardships for "years, as I have good occasion to know, having on one occasion "found a number of Syrian species alive and active when taken from "the box-prison in which they had been packed with dry sand on "the Arabian desert quite two and a-half years before; in each case "the usual air-tight curtain had been drawn across the aperture of the

"shell, but a drop or two of water quickly dissolved this, and a few "minutes later the animal awoke from its deathlike sleep, as fat and "vigorous as though only a night had passed since its incarceration."

In England the largest "snail," only too common in gardens, makes a very rich and nourishing broth. I remember an old lady, a neighbor of ours, very kind to the poor and sick, whose favorite prescription for many ailments was a broth made from these snails, but I do not think she ever told her patients what it was made of, unless it was a long time afterwards, I could never be prevailed upon to taste it, and so cannot say from experience if it was really as nice as she made it out to be.

On the banks, under hedges, along country lanes, land shells, especially Helices, are very plentiful, and as some of the larger ones are very handsome, the shells both dead and alive are very noticeable. The moister climate, no doubt, accounts for the great abundance of snail life in England. I hope before the year is over to get specimens of some of these species, and I shall be most happy to produce them at one of our meetings.

I believe over 40,000 species of marine, fresh water and land shells are known. The late G. W. Tryon, Jr.., whose death occurred in February last, was, since the death of Mr. Lea, perhaps, the most prominent Conchologist of the day. His collection, in the Academy of Natural Sciences, Philadelphia, is stated to be one-third larger than that of the British Museum, the only other collection with which it can be compared. Andrew Garrett, another noted Conchologist, died in November, last year. He lived on the Island of Huahine, Society Group, South Seas. His private collection of shells (lately for sale) consisted of over 8,000 species, comprising over 30,000 examples, representing almost every known part of the globe. Of this large collection Mr. Garrett had himself gathered some 4,000 species. Mr. Horace F. Carpenter, in his interesting work, entitled, "The Shell-bearing Mollusca of Rhode Island," referring to clams, says:—"It is said that if clams are placed in a basin of sea water "containing indigo, they will in a short time render it perfectly clear, "by collecting the minute particles of the impurity and condensing "them into solid form; and not only indigo but whatever particles "may be contained in the water, organic or inorganic, animal, vegeta-"ble or mineral are thus removed, and the water purified. The

"thousands who visit our shores every summer to partake of the "luscious clam-bake of Rhode Island, may not be aware that they "are filling-up on the sewage of the city, but as no one was ever "known to be injured by eating any amount of them, concentrated "and refined sewage obtained in this way must be healthy." Again he writes:—"The term clam is applied to this species (Mya arenaria) "only in New England. In New York and farther south a clam "means what we call "a guahog" Venus Mercenaria, but the origiual "owner of this name is a ponderous bivalve of the Pacific Coral "Lagoons, Tridacna Gigas, a small valve of which may be seen hang-"ing over the door of an oyster saloon on College Street, in Provi-"dence. I have seen a pair of valves of this species, measuring two "feet across and weighing about 500 lbs., used for a holy water "font in a church in Paris."

I wish I could prevail on some of the working members of this Section, or members of the Hamilton Association, to take up the study of Conchology, or at any rate to become collectors of shells. There is much to be done. I think I am correct in saying that this district has never been worked—by this I mean that our woods and waters have not been systematically examined to see what they may contain in the "snail" line. The study is a very interesting one, and the mere collecting not the least enjoyable portion of it. Many arguments might be advanced in favor of collecting, not particularly shells, but specimens, entomological, botanical, geological, &c;—I will be content with one. It is necessary in order to secure good specimens and a large collection, and at the same time to acquire some knowledge of the habits and habitat of one's captures, to often go abroad into the woods and along or on our water courses and to explore our surroundings thoroughly. The mere exercise of walking in the fresh country air is very beneficial, especially so to one whose business or occupation keeps him much in doors. I think any one who has once commenced to collect in any branch of science will find it very difficult to entirely give it up, there is so much to be learnt, so much to be seen by the careful observer; the lover of nature and nature's beauties will indeed see much to interest and instruct whenever he takes his walks abroad. I should like to see a numerous band of workers in every branch this coming season, then I feel sure that the result by the end of it would be one of which this Association might be proud.

FRESH-WATER CONCHIFERA.

UNIO PRESSUS, *Lea.*

A few specimens from Dundas Marsh, May 6th.

UNIO LUTEOLUS, *Lam.*

Common in Hamilton Bay. A very variable species.

UNIO COMPLANATUS, *Sol.*

Very common in Hamilton Bay.

UNIO NASUTUS, *Say.*

A few specimens taken from Hamilton Bay.

ANODONTA OVATA, *Say.*

A few specimens found in Dundas Marsh, May 6th.

ANODONTA FLUVIATILIS, *Dillwyn.*

Common in Hamilton Bay.

ANODONTA BENEDICTII, *Lea.*

Hamilton Bay.

Several of these species were taken in abundance after the severe storm of Jan. 9th last, along the shore of one of the inlets of the bay near the city, and especially imbedded in the ice near the shore; specimens secured having to be chopped out with a knife. Some single valves taken at the same time and some on the shore at Port Dover were of different species, but in too poor condition for determination.

SPHŒRIUM SULCATUM, *Lam.*

Hamilton Bay. A few specimens, differing somewhat, were returned labelled S. SULCATUM, var.

SPHŒRIUM RHOMBOIDEUM, *Say.*

SPHŒRIUM STRAMINEUM.

The latter two species were taken plentifully on May 6th, from a muddy little creek running into the marsh near Dundas. At an angle in its course there had been a wash-out, and the bank just there was covered with these tiny bivalves. A number of univalves were also found here.

SPHŒRIUM OCCIDENTALE, *Prime.*

Plentiful in a small stream or run in open woods, May 13th. Late in the summer more were taken alive from the dried up bed of the same stream.

FRESH-WATER GASTEROPODA.

(OPERCULATE)

MELANTHO DECISUS, *Say.*

Hamilton Bay. Some very fine specimens from Dundas Marsh on May 6th.

PLEUROCERA SUBSULARE, *Lea.*

Hamilton Bay. Not common.

GONIOBASIS LIVESCENS.

Hamilton Bay.

VALVATA TRICARINATA, *Say.*

Common in Hamilton Bay.

VALVATA SINCERA, *Say.*

Common in Hamilton Bay.

AMNICOLA ———.

I have at least three species of Amnicola from Hamilton Bay not yet named.

(NON-OPERCULATE.)

LIMNŒA PALUSTRIS, *Mull.*

A very variable shell, common in all streams and the inlets of Hamilton Bay.

LIMNŒA CAPERATA, *Say.*

Taken in the same stream as *Sphœrium occidentale.*

LIMNŒA HUMILIS, *Say.*

From torrent in Chedoke Ravine, May 13th; Dundas Ravine, May 24th.

LIMNŒA STAGNALIS, *Linn.*

Common in inlets of Hamilton Bay and in Dundas Marsh. This species appears to be found in many different parts of the world.

LIMNŒA DESIDIOSA, *Say.*

Taken abundantly in September at Isle D'Orleans, near Quebec.

LIMNŒA CATASCOPIUM, *Say.*

A single specimen was found in the same locality as the last.

Some specimens of *Limnœa* taken in our district this season may

prove to be different to the above, while *Limnœa catascopium* will, I expect, be found in Lake Ontario.

PHYSA GYRINA, *Say*.

Scarce in different pieces of water in this neighborhood.

PHYSA ANCILLARIA.

A few specimens were picked up on the shore at Port Dover, and it may be found here in the Lake.

The Rev. G. W. Taylor has retained nearly all my *Physas* for further examination. I expect to get at least two more species from among them.

BULINUS HYPNORUM, *Linn*.

Abundant in small streams running through open woods. Some fine specimens have been secured this year.

PLANORBELLA CAMPANULATA, *Say*.

HELISOMA TRIVOLVIS, *Say*.

HELISOMA BICARINATUS, *Say*.

The last three species abound in stagnant pieces of water in our district.

SEGMENTINA ARMIGERA, *Say*.

A single specimen was taken in Dundas Marsh on May 6th. A peculiarity of this shell is that it has five small teeth at some distance from its mouth; in fact to see these teeth plainly it is necessary to break away a portion of the shell.

GYRAULUS ———.

Several species from Hamilton Bay and Dundas Marsh have not yet been determined. *G. deflectus* and *G. hirsutus* should be among them.

ANCYLUS RIVULARIS, *Say*.

A few specimens were found attached to the valves of dead *Unios*, cut out of the ice after the storm of Jan. 9th.

TERRESTRIAL GASTEROPODA.

(OPERCULATE.)

POMATIOPSIS LAPIDARIA, *Say*.

A terrestrial species of a fresh-water genus. This shell is new

to the Canadian list, but is comman in some parts of the United States. It was first collected on Nov. 15th, last year, in a ravine running down to the Marsh, and has been found this year to be generally distributed around the Marsh, but has not been taken in abundance.

(NON-OPERCULATE.)

HYALINA NITIDA, *Say.*

Common everywhere in damp places, under logs, etc.

HYALINA INDENTATUS, *Say.*

A few specimens only have been found under moss on decaying stumps and logs, along the side of the Mountain.

One or two species of *Hyalina* are still to be determined.

PATULA ALTERNATA, *Say.*

PATULA STRIATELLA, *Anthony.*

These two species are common everywhere in woods and damp spots.

PATULA PERSPECTIVA, *Say.*

This shell appears to be rare here, a few only having been found along the side of the Mountain.

MESOMPHIA FULIGINOSUA.

Taken May 5th, on a mossy bank, at the mouth of a ravine running down to the Dundas Marsh. One specimen only was found last season.

TRIODOPSIS PALLIATA, *Say.*

Not common. Along the Mountain side.

TRIODOPSIS TRIDENTATA, *Say.*

In same locality as the last species, but more abundant.

STENOTREMA MONODON, *Rackett.*

A variable shell. One or two specimens only have been taken.

STENOTREMA MONODON, *Rackett.* var. FRATERNUM.

This is considerably larger than the type and has the umbilicus closed. It is common in woods.

MESODON ALBOLABRIS, *Say.*

MESODON THYROIDES, *Say.*

Both the above species are abundant throughout this district.

MESODON SAYI.

A rare shell, only one specimen having been taken here last season, the exact locality being unknown. This species, at first sight, somewhat resembles *M. thyroides*, but has a much larger umbilicus, also a small tooth on the lip which may be easily overlooked. On Good Friday, April 19th, a dead specimen was obtained in the ravine, under the Albion Mills, showing one locality, at any rate, where it may be found.

FRUTICICOLA CANTIANA.

Observed in thousands along the heights overlooking the St. Lawrence River, near Quebec, last September. This Helix has been imported from England or Europe, and perhaps it is only a question of time before it has travelled this way.

FERRUSACIA SUBCYLINDRICA, *Linn.*

Common on banks and in open woods under logs.

STROBILA LABYRINTHICA, *Say.*

A few specimens were taken from a stream in woods, March 16th.

PUPA CONTRACTA, *Say.*

Found in a stream in woods.

PUPA CORTICARIA, *Say.*

Found in a stream in woods and also under loose bark on logs.

PUPA ARMIFERA, *Say.*

Very common on a dry, sunny bank overlooking Hamilton Bay, towards the Valley Inn, March 17th.

PUPA FALLAX, *Say.*

In same locality as last species, but much more rare. Only once previously reported from Canada.

CARYCHIUM MINIMUM.

Common everywhere in damp spots under logs. This is the smallest shell yet taken.

SUCCINEA OBLIQUA, *Say.*

SUCCINEA AVARA, *Say.*

These two Succineas are common in woods near streams.

SUCCINEA OVALIS.

Common along the shores of the Dundas Marsh and some parts of Hamilton Bay.

Two species of *Pupa* and three other varieties of small land shells, taken this season, have not yet been determined.

GEOLOGICAL NOTES.

BY D. F. H. WILKINS, B. A., BAC. APP. SCI., PRINCIPAL, HIGH SCHOOL, BEAMSVILLE.

Read before the Hamilton Association.

Among the many interesting features of the rocks of Western Ontario are some to which, it is believed, attention has not as yet been directed. One of these may be noted as occurring on and near the Credit River, Streetsville, Peel County, Ontario, and as presenting to us as nearly as possible the junction between the Hudson River or Cincinnati Group, the highest member of the Upper Cambrian or Lower Silurian of Murchison, and the Medina Group, the lowest but one member of the true Silurian or Upper Silurian of the famous geologist referred to. The flat, generally clay country of Peel county slopes gradually south-westward to the Credit River at Streetsville, and on the north-east bank of this stream may be seen, below some six to ten feet of clay, a series of greenish gray sandstones and argillo-arenaceous shales, some of the former being sufficiently thick-bedded to afford good flagstones. The series extends, as may indeed be clearly seen, under the river, and has a thickness exposed on the bank of from eighty to ninety feet. Moreover, from the more weathered shales and sandstones may be procured the following fossils typical of the Hudson River or Cincinnati Group;—*Tetradium fibratum*, *Columnaria alveolata*, *Favistella stellata*, *Favosites hemispherica*, *Petraia Canadensis*, *Ambonychia radiata*, *Modiolopsis modiolaris*, *Avicula demissa*, *Strophomena alternata*, *Orthis testudinaria*, and more rarely, *Orthis occidentalis* and fragments of an undetermined *Orthceras*. The river here has a well defined trend, south, twenty degrees east, or nearly so, and thus nearly conformable to the strike of the strata, this latter being more accurately south, twenty-five degrees east, the dip being, of course, south of west, at a very low angle. The flood-plain of the river varies from a hundred feet to a hundred yards in

width; and the south-west bank rising from this is composed of brown, unstratified clay, concealing the shales and sandstones. The slope of the bank is sometimes steep and sometimes gradual, and upon its flat summit stands the village, extending in a direction parallel to the river for a distance of one mile and a-half in length, and in a direction at right angles to this of one-eighth of a mile in breadth. Carrying a section from the river bed to the south-west, we find, after crossing the main street of the village a slight fall, nowhere greater than fifteen feet to the Canada Pacific Railway (Credit Valley Branch); then a slight rise and fall to a small creek, a feeder of the Credit, and finally a rise, gradual at first, succeeded by a low escarpment of about forty feet in height. The lower part of this rise is clayey, while in the middle part is exposed, at a distance of not more than a quarter of a mile south-west of the river, about twenty feet of red Medina shale, with here and there a thin layer of sandstone, striped and spotted with green as usual, destitute of fossils, except a few obscure fucoids. This rock, it may be added, is largely quarried in the manufacture of terra-cotta. Following the strike of the rock a lower layer of red shale may be seen about twenty-five feet below the just mentioned exposure. Finally, near the railroad station, are exposed, in the bed of the creek above referred to, some grey, brown weathering, unfossiliferous sandstones, distant about one-eighth of a mile north-east from the last mentioned outcrop of Medina rock. These are probably transition beds, revealing to us the gradual shallowing of the sea bottom with the consequent destruction of the organic life of the period. Thus we see that although the actual line of junction between the two groups of rock is not so far visible, yet its position may be approximately found.

In finding this we perceive another interesting fact, namely, the height of these beds above Lake Ontario. The heights are here given:—

Height of the uppermost bed of Hudson River sandstone on the north-east bank of the Credit..............	240 feet.
Height of the unfossiliferous gray, brown weathering bed, one eighth of a mile south-west of the above, and near the railway station..........................	245 "

Height of station	252	feet.
Height of main street of village	275	"
Height of lowest Medina bed	270	"
Height of lowest layer or section, quarried for terra-cotta	295	"

From the above it may be reasonably inferred that the height of the line of junction between the two groups of rock (Hudson River and Medina) is about *two hundred and sixty feet* above Lake Ontario.

The most interesting fact of all, however, appears, when we remember that this same line of junction reaches the north shore of Lake Ontario, near Oakville, at a distance of eleven miles from Streetsville, and in the direction S. 24° 8′ 32″ E., or approximately S. 25° E. This being, as has been already said, the line of the strike of the formations, it follows that the difference of level gives us the side of a low flat anticlinal of dip S. 25° E., and rate of 25 feet to the mile nearly, the axis of the anticlinal lying in the direction of the dip of the strata, and nearly parallel to the well-known, striking Cincinnati anticlinal arch. So far, the other side of this anticlinal fold, or even its summit, has not yet been found, but more thorough search may reveal it in the river beds of the counties of Peel or of Dufferin.

ANNUAL REPORT

SESSION 1888–9.

HAMILTON ASSOCIATION

HAMILTON, ONTARIO,

(For the Promotion of Literature, Science and Art.)

Presented May 9th, 1889.

The session just closed has been, on the whole, a successful one, whether the character of the work done, or the interest of the members therein, be considered.

Six general meetings of the Association have been held during the Session, at which the following papers have been read, viz.:—

"Notes on Primitive Man," by W. Kennedy.

"Notes on the Waverley Novels" (2nd part), by Rev. C. H. Mockridge, D. D.

"History of Pottery and Ceramic Art," by S. J. Ireland.

"Selenography," by H. B. Witton.

"Notes on the Lingulæ of the Silurian Rocks," and "Notes on the Origin of Chert (Flint) in our Local Niagara Rocks," by Col. C. C. Grant.

Since last annual meeting the Association has held one general field day. Through the kindness of Mr. William Gibson, the members of the Association and their friends were invited to visit his extensive quarries near Beamsville; so, on the morning of the 30th of June last, a party of about thirty found themselves in a *special car*, through the kindness of Mr. Chas. Stiff, Superintendent of the Southern Division of the Grand Trunk Railway. On arrival at Beamsville the car was detached from the train and awaited us for the return jour-

ney. We found Mr. Gibson in waiting to receive us, and a number of carriages to convey us to the quarries on the top of the escarpment. Here we arrived about 12 o'clock, and after partaking of lunch under the shade of the trees, and being photographed by Messrs. Charlton and Baker, we divided up into sections, to examine the botanical, entomological and geological character of the locality, after which we gathered near the quarries and reviewed the various specimens which had been collected. Some time was spent in examining the mode of blasting, splitting and raising the enormous blocks of stone, and placing the same upon trucks for conveyance to the main line of the Grand Trunk Railway, by means of the tramway which connects the quarries with the railway at Beamsville Station. Mr. Gibson arranged that the party should return by a different route, calling on the way at his handsome residence, where refreshments were generously served. The drive was a very beautiful one, and a hearty vote of thanks was passed to Mr. Gibson for his kindness in affording the members of the Association the opportunity of spending such a pleasant day.

As this field day was not so well patronized as it should have been, your Council deemed it unwise to make arrangements for a second in the same season, though we hope one or two successful ones will be arranged for this summer.

The thanks of the Association are also due to Messrs. John Fisher & Sons, of Dundas, for permission for the members to visit the ravine for botanical purposes.

We cannot close this report without referring to the death of two members of the last Council of this Association.. We mean the late William Milne, who, from the time of his becoming a member, took a deep interest in all relating to the welfare of our Society, and contributed a very valuable paper on "The Public Treatment of Crime and Criminals," which was published in our Transactions; and Dr. Chittenden, whose sudden death yesterday shocked the community, by whom he was so much respected. His taking away comes near to us in this Association, for he was deeply interested in all our operations, and was ready to do all he could for its success. It is not the place or occasion to speak of his kindly and cheer-

ful disposition, and of his other personal qualities, so highly appreciated by all of us. We would also put on record our regret at the removal from our city of the Rev. Dr. Mockridge, an ex-President of this Association, and one who, when in office, contributed much to its success. Our best wishes attend him in his new home.

All of which is respectfully submitted.

A. ALEXANDER,
Secretary.

Financial Statement.

Statement of Receipts and Disbursements for Year Ending 9th May, 1889.

RECEIPTS.

Balance as per Statement, 1888	$ 63 53
Government Grant	400 00
Subscriptions	165 00
Sale of Books	31 50
	$660 03

DISBURSEMENTS.

Postage and Commission	$ 55 00
Gas	9 84
Books, Stationery, Printing and Advertising	192 90
Rent	200 00
Insurance	12 50
Furniture	12 50
Balance	163 49
	$660 03

RICHARD BULL,
Treasurer.

I have examined and compared the vouchers with the above, and find it correct.

A. T. NEILL,
Auditor.

May 9th, 1889.

Report of Curator and Librarian.

DONATIONS TO THE MUSEUM.

Presented by Mr. T. C. Mewburn.
- Indian shell epaulet.
- Indian mallet.
- Old gun-barrel and hatchet found under an upturned tree.
- Iron lance of ancient date and small swivel-gun used in Hudson Bay Co's. forts.
- Old Canadian Government Seal for land patents.
- Cut and polished specimen of a large Ammonite.
- Old musket-lock from battle ground (Nov. 1812) of Queenston Heights.
- Old engravings and maps.

Presented by Mr. C. Hardy.
- Bayonet from battlefield (June, 1866) of Ridgeway.

Presented by Rev. A Belt.
- Fenian musket from same locality.

Presented by Mr. S. Symons.
- Specimens of silver and copper ores.
- Model of hull of ship.

Presented by Miss Savage.
- Chimney swallow's nest.

Presented by Mrs. R. Thomson.
- Diamond in its native clay dug from Kimberly Mine, South Africa.

Presented by Mr. S. Briggs.
- Stuffed kangaroo.

Presented by Mr. J. Turnbull.
Large bust of Shakespeare.

Presented by Mr. R. Russell.
Specimen of Galena from the Iron Mountain.

Purchased by the Association.
Five cases Canadian insects.

Special mention must be made of the generosity of Mr. S. Symons, who kindly presented to the Association a handsomely carved chair and table for the use of the President, also four beautiful stands for glass cases in the Museum.

BOOKS ADDED TO THE LIBRARY.

3 vols. "U. S. Government Report of Geological Surveys," 1882-85.

2 vols. "Three cruises of the U. S. Steamer Blake," an account of deep sea dredgings, 1877-80. Presented by Harvard College.

16 parts "Natural History of Victoria," with colored engravings. Presented by Australian Government.

Vol. VI. "Transactions Royal Society of Canada." Presented by the Royal Society of Canada.

Vol. I. "History of America," by Justin Winsor. This completes this valuable work, which is in seven volumes.

"Lives of the Cæsars." Presented by Mr. Haigh.

"Monumental Effigies of Temple Church," London, England. Presented by Mr. Haigh.

ALEX. GAVILLER,
Curator and Librarian.

ANNUAL REPORT

—OF THE—

Biological Section (Botany and Zoology)

HAMILTON ASSOCIATION,

SESSION 1888-89.

C. S. Chittenden, D. D. S., Chairman. T. W. Reynolds. M. D., Secretary.

During the past session the work of this section has been carried on with much enthusiasm by the members, and it is hoped with much profit to themselves, the Association and the community at large.

It was originally intended that regular monthly meetings should be held during the summer, and bi-monthly during the winter; however, owing to the absence of members from the city during the months of June, July and August no monthly meetings were held, but on September 7th, 1888, the bi-monthly meetings were resumed and continued throughout the winter.

The meetings in September and October were devoted to the examination of specimens collected during the summer, and the reception of reports on the work done. At the meeting on October 19th, Mr. McIlwraith reported for the Orinthological division, while Mr. J. Alston Moffat reported for the Entomological, showing that he had obtained about twenty-five specimens during the summer that were new to him, and some of them possibly new to Canada.

At the meeting on October 5th, it was decided that the field of operations, to be called the Hamilton district, should be that portion of country included in a circle, with a radius of twelve miles, extending from the City Hall, Hamilton.

The annual meeting of the section was held on November 2nd, when the officers were elected and the Secretary's report was pre-

sented. Dr. Burgess also then presented a report of the work done by the Botanical division, stating that of the 812 plants recorded in Logie's and Buchan's lists, over 300 had been noted and verified, while 6 or 7 not there recorded had been added to the list.

Although but few formal papers have been read during the winter, yet informal, but none the less profitable, discussions have been held at all the meetings. The following are the titles of the papers:—

Dec. 7th, 1888.—"Is Species a Natural or Artificial Division in Nature?"—J. Alston Moffat.

Dec. 21st, 1888.—"Notes of a Trip to the West Indies."—B. E. Charlton.

Feb. 15th, 1889.—"The Lake Erie Shore as a Botanizing Ground."—T. J. W. Burgess, M. B., F. R. S. C.

March 8th, 1889.—"Plant Colour."—A. Alexander, F. S. Sc.

March 15th, 1889.—"Notes of a Trip to South Carolina during February, 1889."—T. W. Reynolds, M. D.

April 5th, 1889.—"The Land and Fresh Water Shells of the Hamilton District."—A. W. Hanham.

At the meeting on March 8th, 1889, the Herbarium was fully inaugurated, Dr. Burgess on that evening placing in it specimens that he had mounted, which represented 42 orders, 74 genera, and 87 species, and, at the meeting on March 15th, Mr. Alexander contributed specimens representing 48 additional species.

It might be also mentioned, as showing the work done in a field new to the majority of the members, that Mr. Hanham's paper was illustrated by his collection, made in this district, containing 10 bivalves, 16 non-operculate and 10 operculate univalve shells, and 29 land shells.

In speaking of the work done during the winter, mention must also be made of a valuable series of notes on various subjects in Natural History, contributed by Mr. William Yates, of Hatchley, a corresponding member of the Association, which were read at different meetings of the Section and much appreciated by all who heard them.

The various meetings have been fully reported, not only by the Hamilton papers, but also by the correspondents of the Toronto papers, thus bringing the work of the Section prominently before the notice of the public.

In conclusion, reference must be made to the various excursions made by parties varying in number, which were all much enjoyed by those enabled to participate. The first one was a general field day of the Section, held in the Dundas ravine on May 24th, 1888, in which a large number of members and friends joined; succeeding this were a number of smaller ones, but mention must be particularly made of the Association field day held at Mr. Wm. Gibson's Quarries, Beamsville, on June 30th, 1888, in which many members of the Section participated. Amongst the smaller parties may be mentioned an excursion by four of the members on September 25th, 1888, along the creek leading from the Sulphur Springs, near Ancaster, and another made by six of the members on April 19th, 1889, when Mount Albion was visited, and the ravine leading from the Mills explored. This latter excursion may be considered the opening of the work for 1889, and it is to be hoped is only the forerunner of many others as enjoyable and profitable as those held during the summer of 1888, the results of which have already been pointed out. Much still remains to be done in the Hamilton district, and the officers and members of the Biological Section hope that the members of the Association will give their hearty support to them in their undertaking.

ENTOMOLOGICAL DEPARTMENT.

REPORT ON LEPIDOPTERA BY J. ALSTON MOFFAT.

The season of 1888 was not altogether a favorable one for the Lepidopterist in this locality, its prevailing characteristics being coolness and dryness, yet I secured 25 moths new to me.

During the winter months I obtained from various sources, 16 names that prove to be new to the Canadian list. Some of them belong to insects of former years' captures, whilst several very attractive moths secured last season, are yet undetermined, indicating how much has yet to be done before we have obtained a full knowledge of the lepidopterous fauna of our district.

The following are the new names referred to;

Nonagria fodians, Guen.
Glaea inulta, Grote.
Plusia ni, Hub.
Cymatophora humaria, Guen.
Glaucopteryx caesiata, Borkh.
Botis adapaloides, G. R.
Eurycreon sticticalis, Linn.
Conchylis flocosana, Walk.
Eccopsis olivaciana, Fern.
Steganoptica fasciolana, Clem.
Gelechia bilobella, Zell.
" vagella, Walk.
" alacella, Clem.
Carposina crescentella, Wism.
Blabaphanes dorsistrigella, Clem.
Ypsolophus flavivittellus, Fitch.

The first in this list, *Nonagria fodians*, is one of those insects of peculiar habits, which frequent marshy places, and whose larvæ feed inside of water plants.

Some interesting information has been brought out in correspondence recently, about a closely allied spccies—*Arzama obliquata*—which may in great measure apply to this one also.

The following is a summary:—The food plant is *Typha*, Cattail Flag, which grows in such abundance in our marshes. The female deposits her eggs about the middle of the stalk, and when hatched the young caterpillars at once eat their way into it, feeding downwards, growing as they feed, until, reaching maturity at the end of the season, they have arrived near the bottom of the stalk, where some of them prepare for passing the winter; they enlarge their burrow, lining the bottom with fine cuttings, hibernate in the caterpillar state, change to chrysalids in the spring, and to moths soon after.

Some have been taken from the stalk in the fall, under the level of the water, and in winter, when the ice had to be cut to secure them. Others of them prefer passing the winter on dry ground, and will leave the stalk on which they have fed and swim ashore, if it is necessary to do so, seek out for themselves a hibernacula behind the bark of a decaying stump, under sticks and stones, or some such place, where they make a smoothly rounded cavity in which to pass the winter and undergo their transformations in the spring. Thus, bit by bit, we are learning the interesting and wonderful processes in the life histories of those creatures around us, of whose very existence the vast majority of mankind have no knowledge, but, " they are sought out by all those who take pleasure in them."

sented. Dr. Burgess also then presented a report of the work done by the Botanical division, stating that of the 812 plants recorded in Logie's and Buchan's lists, over 300 had been noted and verified, while 6 or 7 not there recorded had been added to the list.

Although but few formal papers have been read during the winter, yet informal, but none the less profitable, discussions have been held at all the meetings. The following are the titles of the papers:—

Dec. 7th, 1888.—"Is Species a Natural or Artificial Division in Nature?"—J. Alston Moffat.

Dec. 21st, 1888.—"Notes of a Trip to the West Indies."—B. E. Charlton.

Feb. 15th, 1889.—"The Lake Erie Shore as a Botanizing Ground."—T. J. W. Burgess, M. B., F. R. S. C.

March 8th, 1889.—"Plant Colour."—A. Alexander, F. S. Sc.

March 15th, 1889.—"Notes of a Trip to South Carolina during February, 1889."—T. W. Reynolds, M. D.

April 5th, 1889.—"The Land and Fresh Water Shells of the Hamilton District."—A. W. Hanham.

At the meeting on March 8th, 1889, the Herbarium was fully inaugurated, Dr. Burgess on that evening placing in it specimens that he had mounted, which represented 42 orders, 74 genera, and 87 species, and, at the meeting on March 15th, Mr. Alexander contributed specimens representing 48 additional species.

It might be also mentioned, as showing the work done in a field new to the majority of the members, that Mr. Hanham's paper was illustrated by his collection, made in this district, containing 10 bivalves, 16 non-operculate and 10 operculate univalve shells, and 29 land shells.

In speaking of the work done during the winter, mention must also be made of a valuable series of notes on various subjects in Natural History, contributed by Mr. William Yates, of Hatchley, a corresponding member of the Association, which were read at different meetings of the Section and much appreciated by all who heard them.

The various meetings have been fully reported, not only by the Hamilton papers, but also by the correspondents of the Toronto papers, thus bringing the work of the Section prominently before the notice of the public.

In conclusion, reference must be made to the various excursions made by parties varying in number, which were all much enjoyed by those enabled to participate. The first one was a general field day of the Section, held in the Dundas ravine on May 24th, 1888, in which a large number of members and friends joined; succeeding this were a number of smaller ones, but mention must be particularly made of the Association field day held at Mr. Wm. Gibson's Quarries, Beamsville, on June 30th, 1888, in which many members of the Section participated. Amongst the smaller parties may be mentioned an excursion by four of the members on September 25th, 1888, along the creek leading from the Sulphur Springs, near Ancaster, and another made by six of the members on April 19th, 1889, when Mount Albion was visited, and the ravine leading from the Mills explored. This latter excursion may be considered the opening of the work for 1889, and it is to be hoped is only the forerunner of many others as enjoyable and profitable as those held during the summer of 1888, the results of which have already been pointed out. Much still remains to be done in the Hamilton district, and the officers and members of the Biological Section hope that the members of the Association will give their hearty support to them in their undertaking.

ENTOMOLOGICAL DEPARTMENT.

REPORT ON LEPIDOPTERA BY J. ALSTON MOFFAT.

The season of 1888 was not altogether a favorable one for the Lepidopterist in this locality, its prevailing characteristics being coolness and dryness, yet I secured 25 moths new to me.

During the winter months I obtained from various sources, 16 names that prove to be new to the Canadian list. Some of them belong to insects of former years' captures, whilst several very attractive moths secured last season, are yet undetermined, indicating how much has yet to be done before we have obtained a full knowledge of the lepidopterous fauna of our district.

The following are the new names referred to;

JOURNAL AND PROCEEDINGS

—OF THE—

Hamilton Association

FOR SESSION 1889-90.

PART VI.

AUTHORS OF PAPERS ARE ALONE RESPONSIBLE FOR STATEMENTS MADE AND THE OPINIONS EXPRESSED THEREIN.

PRINTED FOR THE HAMILTON ASSOCIATION BY THE
SPECTATOR PRINTING COMPANY.

1890.

OFFICERS FOR 1889-90.

President.

B. E. CHARLTON, Esq.

Vice-Presidents.

T. J. W. BURGESS, M. B., F. R. S. C. J. ALSTON MOFFAT.

Secretaries.

H. B. WITTON, B. A. A. ALEXANDER, F. S. Sc., Lon., Eng.

Treasurer.

RICHARD BULL.

Curator and Librarian.

ALEXANDER GAVILLER.

Council.

COLONEL GRANT. T. W. REYNOLDS, M. D. S. J. IRELAND.
WILLIAM TURNBULL. A. W. HANHAM.

Museum and Library.

NEW PUBLIC FREE LIBRARY BUILDING,
Main Street West, near James.

NOTICE.

THE HAMILTON ASSOCIATION was instituted on 2nd November, 1857, and continued its regular meetings to the close of the year 1860. During the period between 1861 and 1871, the meetings were held at irregular intervals, the office bearers of 1860 holding office in the meantime. During the years 1871, 2, 3, 4, and 5, the association was more active in its work, regular meetings being held. An interregnum of four years ensued from 1875 to 1880, during which time the Council met at stated intervals. From 1880 to the present time the Association has been in active operation, the Annual Meeting held in May, 1890, being the one hundred and sixty-fourth meeting of the Association.

The Association was incorporated in 1883.

OFFICE-BEARERS.

	President.	1st Vice-Pres.	2nd Vice-Pres.	Cor. Sec.	Rec. Sec.	Treas.	Libr. and Cur.
1857	Rev. W. Ormiston, D.D.	John Rae, M. D., F. R. G. S.	J. B. Hurlburt, M.A., L.L.D.	T. C. Keefer, C. E.	Dr. Craigie ...	W. H. Park...	A. Harvey.
1858	John Rae, M. D., F. R. G S.	Rev. W. Ormiston, D. D.	J. B. Hurlburt, M.A., L.L.D.	T. C. Keefer, C. E.	Dr. Craigie ...	W. H. Park...	A. Harvey.
1859	Rev. W. Ormiston, D. D.	J. B. Hurlburt, M.A., L.L.D.	Chas. Robb.......	T. C. Keefer, C. E.	Dr. Craigie ...	W. H. Park...	A. Harvey.
1860	Rev. W. Inglis, D.D.	T. McIlwraith	Rev. W. Ormiston, D. D.	Dr. Craigie ...	Wm. Craigie ..	W. H. Park...	Chas. Robb.
1861	Rev. W. Ormiston, D. D.	J. B. Hurlburt, M.A., L.L.D.	Rev. W. Inglis, D.D.	Dr. Craigie....	Wm. Craigie ..	W. H. Park...	T. McIlwraith.
1871	W. Proudfoot	Judge Logie.......	R. Bull...........	J. M. Buchan, M. A.	I.B.McQuesten M. A.	W.G.Crawford	T. McIlwraith.
1872	Judge Logie.......	H B. Witton, M.P.	R. Bull...........	J. M. Buchan, M. A.	I.B.McQuesten M. A.	W.G.Carwford	T. McIlwraith.
1873	H. B. Witton, M.P.	J. M. Buchan, M.A.	A. T. Freed	Geo. Dickson, M. A.	Geo. Dickson, M. A.	R. Bull.......	T. McIlwraith.
1874	H. B. Witton, M.P.	J. M. Buchan, M.A.	A. T. Freed	Geo. Dickson, M. A.	Geo. Dickson, M. A.	R. Bull.......	T. McIlwraith.
1875	H. B. Witton,.....	J. M. Buchan, M.A.	W. H. Mills......	Geo. Dickson, M. A.	Geo. Dickson, M. A.	A. Macallum, M. A.	T. McIlwraith.
1880	T. McIlwraith.....	Rev. W. P. Wright, M. A.	H. B. Witton	R. B. Hare, Ph. D.	Geo. Dickson, M. A.	R. Bull.......	A. T. Freed.
1881	J. D. Macdonald, M. D.	R. B. Hare, Ph. D.	B. E. Charlton....	Geo. Dickson, M. A.	A. Robinson, M. D.	R. Bull.......	W. H. Ballard, M. A.
1882	J. D. Macdonald, M. D.	B. E. Charlton....	J. A. Mullin, M. D.	Geo. Dickson, M. A.	Wm. Kennedy.	R. Bull.......	W. H. Ballard, M. A.

1883	J. D. Macdonald, M. D.	B. E. Charlton	H. B. Witton	Geo. Dickson, M. A.	Wm. Kennedy,	R. Bull.......	W. H. Ballard, M. A.
1884	J. D. Macdonald, M. D.	H. B. Witton	Rev. C. H. Mockridge, M.A., D.D.	Geo. Dickson, M. A.	A. Alexander..	R. Bull.......	Wm. Turnbull.
1885	Rev. C. H. Mockridge, M.A., D.D.	Rev. S. Lyle	W. Kennedy	Geo. Dickson, M. A.	A. Alexander..	R. Bull	A. Gaviller.
1886	Rev. C. H. Mockridge, M.A., D.D.	Rev. S. Lyle	Matthew Leggat ..	Geo. Dickson, M. A.	A. Alexander.. F. S. Sc.	R. Bull	A. Gaviller.
1887	Rev. S. Lyle, B. D.	B. E. Charlton ...	W. A. Child, M.A.	H. B. Witton, B. A.	A. Alexander.. F. S. Sc.	R. Bull.......	A. Gaviller.
1888	Rev. S. Lyle, B. D.	T. J. W. Burgess, M.B., F.R.S.C.	W. A. Child, M.A.	H. B. Witton, B. A.	A. Alexander.. F. S. Sc.	R. Bull.......	A. Gaviller.
1889	B. E. Charlton	T. J. W. Burgess, M.B., F.R.S.C.	J. Alston Moffat...	H. B. Witton, B. A.	A. Alexander.. F. S. Sc.	R. Bull.......	A. Gaviller.
1890	B. E. Charlton	J. Alston Moffat...	A. T. Neill........	H. B. Witton, B. A.	A. Alexander.. F. S. Sc.	R. Bull.......	A. Gaviller.

OFFICE-BEARERS.

	President.	1st Vice-Pres.	2nd Vice-Pres.	Cor. Sec.	Rec. Sec.	Treas.	Libr. and Cur.
1857	Rev. W. Ormiston, D. D.	John Rae, M. D., F. R. G. S.	J. B. Hurlburt, M.A., L.L.D.	T. C. Keefer, C. E.	Dr. Craigie ...	W. H. Park...	A. Harvey.
1858	John Rae, M. D., F. R. G S.	Rev. W. Ormiston, D. D.	J. B. Hurlburt, M.A., L.L.D.	T. C. Keefer, C. E.	Dr. Craigie ...	W. H. Park...	A. Harvey.
1859	Rev. W. Ormiston, D. D.	J. B. Hurlburt, M.A., L.L.D.	Chas. Robb.......	T. C. Keefer, C. E.	Dr. Craigie ...	W. H. Park...	A. Harvey.
1860	Rev. W. Inglis, D.D.	T. McIlwraith	Rev. W. Ormiston, D. D.	Dr. Craigie ...	Wm. Craigie ..	W. H. Park...	Chas. Robb.
1861	Rev. W. Ormiston, D. D.	J. B. Hurlburt, M.A., L.L.D.	Rev. W. Inglis, D.D.	Dr. Craigie....	Wm. Craigie ..	W. H. Park...	T. McIlwraith.
1871	W. Proudfoot	Judge Logie.......	R. Bull...........	J. M. Buchan, M. A.	I.B.McQuesten M. A.	W. G. Crawford	T. McIlwraith.
1872	Judge Logie.......	H B. Witton, M.P.	R. Bull...........	J. M. Buchan, M. A.	I.B.McQuesten M. A.	W. G. Carwford	T. McIlwraith.
1873	H. B. Witton, M.P.	J. M. Buchan, M.A.	A. T. Freed	Geo. Dickson, M. A.	Geo. Dickson, M. A.	R. Bull.......	T. McIlwraith.
1874	H. B. Witton, M.P.	J. M. Buchan, M.A.	A. T. Freed	Geo. Dickson, M. A.	Geo. Dickson, M. A.	R. Bull.......	T. McIlwraith.
1875	H. B. Witton,.....	J. M. Buchan, M.A.	W. H. Mills......	Geo. Dickson, M. A.	Geo. Dickson, M. A.	A. Macallum, M. A.	T. McIlwraith.
1880	T. McIlwraith.....	Rev. W. P. Wright, M. A.	H. B. Witton	R. B. Hare, Ph. D.	Geo. Dickson, M. A.	R. Bull.......	A. T. Freed.
1881	J. D. Macdonald, M. D.	R. B. Hare, Ph. D.	B. E. Charlton....	Geo. Dickson, M. A.	A. Robinson, M. D.	R. Bull.......	W. H. Ballard, M. A.
1882	J. D. Macdonald, M. D.	B. E. Charlton....	J. A. Mullin, M. D.	Geo. Dickson, M. A.	Wm. Kennedy.	R. Bull.......	W. H. Ballard, M. A.

1883	J. D. Macdonald, M. D.	B. E. Charlton	H. B. Witton	Geo. Dickson, M. A.	Wm. Kennedy,	R. Bull.......	W. H. Ballard, M. A.
1884	J. D. Macdonald, M. D.	H. B. Witton	Rev. C. H. Mockridge, M.A., D.D.	Geo. Dickson, M. A.	A. Alexander..	R. Bull.......	Wm. Turnbull.
1885	Rev. C. H. Mockridge, M.A., D.D.	Rev. S. Lyle	W. Kennedy	Geo. Dickson, M. A.	A. Alexander..	R. Bull	A. Gaviller.
1886	Rev. C. H. Mockridge, M.A., D.D.	Rev. S. Lyle	Matthew Leggat ..	Geo. Dickson, M. A.	A. Alexander.. F. S. Sc.	R. Bull	A. Gaviller.
1887	Rev. S. Lyle, B. D.	B. E. Charlton ...	W. A. Child, M.A.	H. B. Witton, B. A.	A. Alexander.. F. S. Sc.	R. Bull.......	A. Gaviller.
1888	Rev. S. Lyle, B. D.	T. J. W. Burgess, M.B., F.R.S.C.	W. A. Child, M.A.	H. B. Witton, B. A.	A. Alexander.. F. S. Sc.	R. Bull.......	A. Gaviller.
1889	B. E. Charlton	T. J. W. Burgess, M.B., F.R.S.C.	J. Alston Moffat...	H. B. Witton, B. A.	A. Alexander.. F. S. Sc.	R. Bull.......	A. Gaviller.
1890	B. E. Charlton	J. Alston Moffat...	A. T. Neill........	H. B. Witton, B. A.	A. Alexander.. F. S. Sc.	R. Bull.......	A. Gaviller.

LIST OF

Corresponding, Honorary and Life Members

—OF THE—

HAMILTON ASSOCIATION.

ELECTED. CORRESPONDING MEMBERS.

1881 Clark, Chas. K, M. D., Rockwood Asylum, Kingston, Ont.
1881 Van Wagner, P. S., J. P., Stoney Creek, Ont.
1884 Bull, Rev. George A., M. A., Niagara Falls, S., Ont.
1882 Lawson, A. C., M. A., Geological Survey of Canada, Ottawa, Ont.
1881 Spencer, J. W., Ba. Sc., Ph. D., F. G. S., Columbia, Mo., U. S.
1870 Wright, Prof. W. P., M. A., Los Angelos, California.
1871 Seath, John, M. A., High School Inspector, St. Catharines, Ont.
1885 Frood, T., Sunbury, Ont.
1889 Yates, William, Hatchley, Ont.
1890 Wilkins, D. F. H., B. A., Beamsville.
1890 William Kennedy, Little Rock, Ark.

HONORARY MEMBERS.

Grant, Lt-Col., Bay St. South, Hamilton, Ont.
Macoun, John, M. A., Government Botanist and Naturalist, Geological Survey of Canada, Ottawa, Ont.
Dawson, Sir J. William, F. R. S., F. G. S., F. R. S. C., Principal McGill College, Montreal, Que.
Fleming, Sanford, C. E., C. M. G., Ottawa, Ont.
Wilson, Sir D., L L. D., Principal University of Toronto, Ont.
Farmer, William, C. E., New York, U. S.
Ormiston, Rev. Wm., D. D., New York, U. S.
Rae, John, M.D., F.R.G.S., L.R.C.S., L.L. D., London, Eng.
Hurlburt, J. B., M. A., L.L. D., Ottawa, Ont.
Small, H. B., Ottawa, Ont.
Charlton, Mrs. B. E., Hamilton, Ont.
Keefer, Thomas C., C, E., Ottawa, Ont.
Symons, S. Hamilton, Ont.

LIFE MEMBERS.

Proudfoot, Hon. Wm., Q. C., Vice-Chancellor, Toronto, Ont.

MEMBERS OF COUNCIL.

1857—Judge Logie; Geo. Lowe Reid, C. E.; A. Baird; C. Freeland.

1858—Judge Logie; C. Freeland; Rev. W. Inglis, D. D.; Adam Brown; C. Robb.

1859—Rev. D. Inglis, D. D.; Adam Brown; Judge Logie; C. Freeland; R. Bull.

1860—J. B. Hurlburt, M.A., L.L.D.; C. Freeland; Judge Logie; R. Bull; Wm. Boultbee; Dr. Laing.

1871—Geo. Lowe Reid, C. E.; Rev. W. P. Wright, M. A; A. Macallum, M. A.; A. Strange, M. D.; Rev. A. B. Simpson.

1872—Judge Proudfoot; Rev. W. P. Wright, M. A.; John Seath, M. A.; H. D. Cameron; A. T. Freed.

1873—Judge Logie; T. McIlwraith; Rev. W. P. Wright, M. A.; A. Alexander; I. B. McQuesten, M. A.

1874—Judge Logie; T. McIlwraith; Rev. W. P. Wright, M. A.; A. Alexander; I. B. McQuesten, M. A.

1875—Judge Logie; T. McIlwraith; Rev. W. P. Wright, M. A.; A. Alexander; I. B. McQuesten, M. A.

1880—M Leggatt; I. B. McQuesten, M. A.; A. Alexander; Rev. A. Burns, M. A., L L. D., D. D.

1881—T. McIlwraith; H. B. Witton; A T. Freed; Rev. W. P. Wright, M. A.; A. F. Forbes.

1882—T. McIlwraith; H. B. Witton; A. T. Freed; A. F. Forbes; Rev. C. H. Mockridge, M. A., D. D.

1883—A. Alexander; A. Gaviller; A. F. Forbes; T. McIlwraith; R. Hinchcliffe.

1884—A. Gaviller; A. F. Forbes; T. McIlwraith; R. Hinchcliffe; W. A. Robinson.

1885—W. A. Robinson; S. Briggs; G. M. Barton; J. Alston Moffat; A. F. Forbes.

1886—J. Alston Moffat; Samuel Slater; Wm. Milne; James Leslie, M. D; C. S. Chittenden.

1887—J. Alston Moffat; James Leslie, M. D.; P. L. Scriven; Wm. Milne; C. S. Chittenden.

1888—J. Alston Moffat; B. E. Charlton, T. W. Reynolds, M.D.; S. J. Ireland; Wm. Kennedy.

1889—T. W. Reynolds, M. D.; S J. Ireland; William Turnbull; A. W. Hanham; Lt.-Col. Grant.

1890—Col. Grant; A. W. Hanham; W. A. Robinson; A. E. Walker; Thomas Morris.

ABSTRACT OF MINUTES

OF PROCEEDINGS OF THE

HAMILTON ASSOCIATION

FOR SESSION 1889-90.

THURSDAY, NOVEMBER 14, 1889.

The opening meeting of the session was held this evening. The retiring President, Rev. Samuel Lyle, B. D., in the chair.

The Curator and Librarian announced that several important additions had been made to the Library and Museum during the recess.

The Secretary reported what the Council had done during the same period, and Dr. Reynolds told of the work done in the Biological Section.

Attention was directed to the improved appearance of the room by the elegant and valuable donation of new stands for the cases made by Mr. S. Symons.

An offer of two extra rooms, without increase of rental, was made by Dr. McQuesten of New York, through Mr. Chisholm, his agent, on condition the Association renewed the lease. It was left in the hands of the President and Secretary.

Messrs. Harry Lee, manager of the Glass Works, and D. J. Campbell, inspector of the Canada Life Assurance Co., were proposed for membership.

At the close of the routine business, the retiring President introduced the new President, B. E. Charlton, Esq., who delivered his introductory address, at the close of which several members expressed their high opinion of its excellence. It will be found among the published papers of this session.

It was announced that the next meeting would be held on the 2nd Thursday of December, when a paper would be read by Mr. Moffat, and also one by Colonel Grant.

The meeting then adjourned.

THURSDAY, DECEMBER 12, 1889.

The President, B. E. Charlton, in the chair.

The minutes of the previous meeting were read and approved.

A hearty vote of thanks was passed to Mr. Symons for his handsome contribution of new stands for the show-cases and other articles of value.

Messrs. Harry Lee and D. J. Campbell were elected members of the Association, and Mr. William Kennedy, of the Geological Survey of the State of Arkansas, U. S. A., was elected a corresponding member of the Association.

Mr. Chas. E. Torrance was proposed for election.

Mr. John A. Barr presented a series of photographic views of Stratford-on-Avon and of Shakespearian views, for which he received the thanks of the Association.

Contributions to the Museum of Indian relics, and some geological specimens were reported from D. J. Campbell.

J. Alston Moffat then read his paper on "The Question of the Variation of Species." A strong desire was expressed that the paper be published.

Colonel Grant also read a paper entitled "Notes Geological and Antiquarian."

At this meeting Mr. Moffat exhibited his large collection of insects, which added much to the instruction and pleasure of the audience.

The meeting then adjourned.

SPECIAL MEETING, DECEMBER 23, 1889.

This meeting was called for the purpose of considering the offer of the Art School Board to give the Association room for its museum and meetings in the new Public Free Library building.

Mr. Charlton presided, and called on the secretary to read the letter received from the directors of the Art School. The Board

offered the Association about 1,200 square feet of floor space for five years, at a yearly rental of $130, exclusive of caretaker, said lease to be concurrent with the Art School lease, and to be renewed for other five years upon the same terms, provided the Art School obtains a like renewal; but no right to sublet except to the "Wentworth Pioneer Association."

The Council having had this proposition before them, recommended the acceptance of the offer of the Art School Board, and that the President and Secretary be authorized to execute a lease upon the terms mentioned, and also that the owner of the premises now occupied be notified that the Association will vacate the same on the 1st of July next.

On motion, these recommendations of the Council were adopted and the meeting adjourned.

THURSDAY, JANUARY 9, 1890.

In the absence of the President, Mr. J. Alston Moffat presided.

The minutes of the previous meeting and of the special meeting were read and confirmed.

Additions to the Museum and Library were reported by the Curator.

Mr. Charles E. Torrance was elected a member of the Association.

A letter from the President was read, suggesting the handing over of the library of the Association to the Trustees of the Hamilton Public Free Library. The matter was discussed by several members, all of whom expressed disapproval of the proposition. It was eventually left in the hands of the Council to decide.

Mr. H. B. Witton then read an excellent paper on "Indian Fable Literature."

After many members expressed their high appreciation of the paper, the meeting adjourned.

THURSDAY, FEBRUARY 13, 1890.

The President in the chair.

The minutes of previous meeting read and approved.

Mr. S. J. Ireland, Principal of the Art School, read a valuable paper on "Color, Chromatics and the Permanency of Pigments."

The subject was very beautifully illustrated by a costly collection of diagrams, very carefully colored, showing the various tints of the colors supplied by Messrs. Rowney, of London, England, to whom a hearty vote of thanks was accorded.

The meeting then adjourned.

THURSDAY, MARCH 13, 1890.

The President in the chair.

The minutes of the February meeting confirmed.

H. B. Small, Esq., of Ottawa, was appointed to represent the Association at the annual meeting of the Royal Society to be held there in May.

A volume of the Slavonic Bible was presented, through Mr. Witton, from Mr. Charles Robinson, who found it in Sebastopol at the close of the Crimean War.

It was reported that the Council suggested that a portion of the Library be *loaned* to the Free Library, and that Messrs. Moffat and Gaviller had been appointed to make a selection of the books to be so used.

Mrs. J. Rose Holden was elected a member of the Association.

Dr. Burgess then read a paper "Notes on the History of Botany."

The paper was full of interesting information regarding the science and indicated a vast amount of research and an intimate knowledge of the subject.

The meeting then adjourned.

THURSDAY, APRIL 10, 1890.

The President in the chair.

The minutes of the previous meeting confirmed.

A letter was read from Professor Wright, of Los Angelos, California, a corresponding member of the Association, conveying to the Association several beautiful specimens of the lower forms of life on the Pacific coast mounted on cardboard. Those sent being forms of the Polyzoa.

A paper on "Coinage and Money," by H. B. Small, of Ottawa, was read by Mr. Witton.

The paper was peculiarly interesting and brimful of information. Hearty thanks were voted to Mr. Small for his paper.

The meeting then adjourned.

THURSDAY, MAY 8, 1890.

The President in the chair.

Minutes of the last meeting confirmed.

It was announced that the Council had considered the question of lending the Association books to the Public Free Library and propose the following:

1. That all the Government Blue Books and Reports—British, Canadian and American—be handed over to the Public Free Library Board as their absolute property.

2. That all the books suitable for the Circulating portion of the Library be handed over for use in that Department, each book to have the Association label attached and to remain the property of the Association.

3. That all the valuable Reports and Transactions of Learned Societies be loaned to the Trustees of the Public Library to be used in the Reference Department of the same, on condition that they be bound at the expense of the Board and have the Association label attached.

4. In case of the Association having at any time to leave the Library building it is to be understood that the books be given up.

A paper on the "River Valleys of the Niagara Escarpment," by D. F. H. Wilkins, B. A., of Beamsville, was read by A. T. Neil, Secretary of the Geological Section. The paper was well received, and a desire expressed that Mr. Wilkins be requested to attend a meeting of the Association next session, so that the subject of his paper might be thoroughly discussed.

The meeting then resolved itself into the Annual Meeting. The President in the chair.

The minutes of the last Annual Meeting were read and confirmed.

The Secretary read his Annual Report.

Mr. A. T. Neill read the Report of the Geological Section, while that of the Biological Section was read by Mr. Hanham. The Curator, Mr. Gaviller, reported the additions made to the

Museum and Library, and Mr. Bull, Treasurer, gave his Financial Statement. All these Reports were adopted and will be found in full at the end of this volume of the Transactions.

The Election of Officers was then proceeded with, resulting as follows:

B. E. Charlton, - - - - -	President.
J. Alston Moffat, - - -	First Vice-President.
A. T. Neill, - - - -	Second Vice-President.
H. B. Witton, B. A., - - - -	Cor. Secretary.
A. Alexander, F. S. Sc., - - -	Rec. Secretary.
Richard Bull, - - - - -	Treasurer.
Alexander Gaviller, - - -	Curator and Librarian.

COUNCIL—A. W. Hanham, Colonel Grant, W. A. Robinson, A. E. Walker and Thomas Morris.

The meeting then adjourned to meet in the new premises on the 2nd Thursday of November.

B. E. CHARLTON,
President.

A. ALEXANDER,
Secretary.

HAMILTON ASSOCIATION

SESSION 1889-90.

THE BENEFITS OF SCIENTIFIC STUDIES, BEING THE OPENING ADDRESS.

BY B. E. CHARLTON, ESQ. (PRESIDENT.)

14th November, 1889.

Ladies and Gentlemen,—

I am sensible of your kindness and courtesy in electing me to the honorable place of first officer of the Hamilton Association, and sensible also of my own indifferent abilities for efficiently discharging the duties thereof.

It is pleasant to be selected for preferment and honor by those with whom one has been long associated in agreeable intercourse, and I would wish to express my acknowledgements and thanks to those around me by whose choice I am placed in this position.

At this the opening meeting of another season of activity, it occurs to me that what I have to say to you to-night might take the line of invitation and solicitation to membership to many worthy friends resident in this city, especially those of literary or scientific tastes, who I am sure would appreciate and enjoy our meetings, and appropriate the benefits to be derived therefrom; and also the line of stimulating and encouraging present members to be active and industrious in promoting the interest and success of our association during the coming winter by preparing, more than usual, papers and lectures upon various subjects, in order that others may enjoy the rich stores of information which they possess.

Anticipating therefore that you will grant me a great deal of latitude and indulgence in this brief address, let me say to the work-

ers in counting house, office or study, whose exhausted brains need healthy relaxation and change of mental food; and to the tired of muscle from busy workshop and the unceasing noise of wheels, and you young people of abundant leisure, surfeited maybe with works of fiction, whose appetites even for the wildest flights of fancy of a Rider Haggard have become dull,—come to our meetings, and we will show you delightful lanes and avenues of mental thought down which you may pleasantly wander and lose all your weariness and satiety in the pursuit of information upon interesting subjects which become appetizing, stimulating, elevating and refreshing, as you proceed.

Let me show you something of the men, and ladies too, who will be your associates and will gladly welcome you to their pursuits, hobbies and summer outings.

Come, and I will introduce you first to members of our geological section, who know the solid framework of our globe, and the history of every rock and pebble, and who will be pleased when the weather is fine, to permit you to go with them to yonder mountain face, and with small hammers open up the great geologic book, on the rocky leaves of which they will show you the indellible records that tell of the earth's days of infancy, and progress from a fiery, molten mass, when ages upon ages ago, the crust was being deposited in hardening strata, disrupted by titanic forces, and re-deposited. Records that tell of the first appearance of life upon the earth, and of the great ice age when the northern half of this continent was enveloped in its glacier cap.

And next, to other members, whose deep researches in ancient literature have made them conversant with the venerable Sanscrit of India, a language unused and forgotten before Greek and Latin were invented, and who can translate therefrom, beautiful thoughts, clothed in glowing words, as the following, being a hymn:

TO THE DAWN. RIG-VEDA, VII, 77.

Bright as a bride, shines forth the virgin day-break,
Arousing all that lives to daily action.
Only freed by man's toil can Agni shine forth,
The dawn brings light by striking down the darkness.

Upwards she rose, and spread, still nearer coming,
With glistening garments clad, she grew in brightness,

Of golden splendor, and of face most comely,
Parent of morning clouds, leader of day-light.

Oh! happy she, blest dawn, the God's eye, bringing
Whitest of steeds, and proudest, sleekest, leading.
In radiance draped, the ruddy morn is coming,
In treasures rich, she tracks the path for mortals.

Or, here are our botanists, old friends and acquaintances of each fair floweret, who can tell you that all the brilliant glory, far exceeding that of Solomon, all the delicate perfume and the tiny pot of honey, were given to each queen of the meadow, not alone to regale your senses, but to invite and reward yonder bustling bee, whose woolly, dusty back, performs such a service in enabling it to perpetuate its posterity. They can tell you of every plant that can possibly be met with in your rambles, and of all their qualities and uses, edible, medicinal or destructive; even of that marvel of construction and destruction, the pitcher plant, whose treacherous lips entice to death the unwary insect seeking to explore its cool recesses for treasure, but once within those shining portals he can nevermore return,—the slippery sides and downward pointing spears leave him no resource but exhaustion, death, and finally absorption.

Then here are our friends the conchologists, in from wandering in leisure hours along streamlet, creek and lakeside, with collections of hundreds of varieties of shells from the tiny foraminifera to the great yawning clam, all beautiful in finish and wonderful in construction.

Over there is our veteran ornithologist with his ambitious pupils, who know every feather that cleaves the sky, and can tell you great things even of the pugnacious sparrow.

And there are the entomologists, chief among them yonder thoughtful man, serious of demeanor, but delightful to know, who spends much of his life among butterflies, moths and beetles; a perfect arsenal of information in his particular hobby. He can tell you of the fascinations of the studies of insect life, and has wondrous things to say of bees and ants; of the ant lion who makes his pitfall in the sand and pounces on his stumbling victims, or of a crawling grub, which, arriving at maturity, feels within itself a great change coming, and admonished of a long night of helpless sleep to end in a new life of gaudy splendor. He will tell you that to prepare for this marvellous transformation it ascends a lofty tree, aware

that if it made its bed upon the ground its life would end in the wet and ice of winter; aware also, by an intuition startling and amazing, that the green leaflet which it proposes to use as a blanket will become withered by the first blast of frost and quickly fall to the ground, it spins a silken cord with which it securely fastens the green leaf to the firm wood of the limb, then wraps itself up for its long sleep. The frost comes and the wind detaches the leaf with its precious burden, but the silken cord holds fast, and the erstwhile crawling grub of astonishing forethought, swings securely in his leafy cradle all through the bleak winter, and when the warm rays of approaching summer stir the life currents of his body he comes forth a glorious butterfly, the beautiful Promethia. Spontaneously there arises in the thoughtful mind the question: Who taught it that the leaf would fall and not the branch?

But here are our historians, who know all about the local history of our country and neighborhood, written and unwritten; all about the discovery of Macassa water, and the battle of Stony Creek.

And astronomers who, in useful telescope, can show you the face of the moon, and name its mountains, volcanoes and vast depressions, with the same familiarity as a schoolboy explains the map of Europe.

Surely in this galaxy of talent you devotees of business or labor may find something attractive or amusing for your leisure hours. Your natural bent or inclination may tempt you to follow one or other of the delightful avenues which I have indicated, or still others, for they are numerous. The microscope and the telescope will lead you beneath and above the limits of vision into the two infinities, between which lies the world which is revealed to our senses, far down among the infinitesimals, or above into the far reaching illimitable fields of splendor, till the brain becomes dizzy amid the whirling worlds.

The limit of natural vision for small objects is about the one-hundredth of an inch. With the microscope the limit of resolving power is somewhere near the one-hundred-thousandth of an inch. One of the most interesting illustrations of the highest power of the microscope is by Dr. Dollinger. He has followed the life history of one of the infusoria down through all its phases, comprised within ten or twelve hours. A full grown individual divides itself lengthwise into two perfect beings in about five minutes. In another five

minutes each of these go through the same operation again, and so on for hours. After from three to seven hours of this kind of multiplication the older ones die off, while some of the younger and more vigorous attach themselves to each other in pairs. One entirely absorbs the body of the other into its own and settles down into the quiet, cysted state. Then after a certain time there commences to ooze out of this body perfect little clouds of the minutest spores, until nothing is left of the parent organism but the shrivelled skin. These spores, at first too small to be resolved by the highest powers of the microscope, soon grow to be visible as distinct points, then to push out their little threads of locomotion, and at length to become full-grown monads, ready to commence the other kind of generation—that of self-division. It is estimated by Dr. Dollinge· that fifty millions of these monads could easily disport themselves in a single drop of water. And there is the easy possibility, and even probability, of other realms of living kingdoms still far below the reach of the microscope.

Turning in the opposite direction, the sharpest eyes can see only about five thousand stars in all the sweep of the heavens. With the highest powers of the telescope it is estimated that twenty millions of stars are visible. Yet all these are only the brightest or the nearest of the suns which compose the great cluster of the Galaxy, or Milky Way, to which system our sun belongs. And this immense aggregation of worlds is only one of thousands of star clusters that are within the range of telescopic observation. Over three thousand star systems, probably in every way similar to the one which lights our night skies, have already been located in the outlying regions of space. And what is there beyond?

Or suppose you try photography and find yourself rambling, with camera in hand, to paint with pencils of sunbeams, pictures, with an accuracy almost divine.

Any, or all of these pursuits, tend to make their votaries, observant, thoughtful, to "see sermons in stones, and good in everything."

Observation, after all, is the great instructor. When a boy, a worthy teacher once said to me. "Be observant. Learn something every day of your life. Do not be like the sailor who has sailed round the world, and when he has returned has no other information to impart than the prices of tobacco and rum in the various ports at which he has touched."

Again, too close application to one pursuit or study is apt to lead one into a narrow groove of intelligence and thought. A book-worm is not a desirable character to imitate.

To you my colleagues, officers and members of this venerable association, who by means of your pursuits, hobbies or fads, have now concealed about your persons such hoards of wisdom, let me urge upon you to be zealous in doing, each your part, in making our meetings interesting during the coming winter, and you will find that the law of compensation will give you a large share in the pleasure which your associates will enjoy.

To one and all I would say, let us make the coming season one of great enjoyment and brilliant achievements in the fields of literature and science. Let us seek to be worthy imitators of our predecessors, the Craigies, Hamiltons, Ormistons, Hurlburts, Raes, or others of the long list of useful men who, all along down the years of the past history of the Hamilton Association have shed lustre on its records.

What more appropriate than the words of the wise man uttered nearly three thousand years ago: "Happy is the man that findeth wisdom and the man that getteth understanding. She is more precious than rubies, and all the things thou canst desire are not to be compared unto her. Length of days are in her right hand, and in her left hand are riches and honor. Her ways are ways of pleasantness and all her paths are peace. Get wisdom, get understanding. Wisdom is the principal thing, therefore get wisdom, and with all thy getting get understanding. Exalt her and she shall promote thee. She shall give to thine head an ornament of grace, and a crown of glory shall she deliver to thee."

ON THE QUESTION OF THE ORIGIN OF VARIATION IN SPECIES.

Read before the Hamilton Association, December, 1889.

BY J. ALSTON MOFFAT.

Neither nature nor science has given us any certain information about the origin of species.

Geologists have found satisfactory evidence that man is one of the very latest species introduced into this scene of life; therefore, he is not in a position to know anything personally about the introduction of the others.

The geological record affords us abundant illustrations of variation, but its species as made by its authorities are artificial to the last degree, therefore quite uncertain.

Variation in existing species is even now going on, and by close observation we may see its progress in nature, whilst man can take hold of some species and vary them almost at his will. No doubt man has by his intelligent control produced varieties that probably never has, and probably never will appear in nature; but the possibility must have been there or he could never have brought them out.

Spontaneous variation is as contrary to the laws of nature as spontaneous generation. Every effect in nature must have its originating cause. A variety appearing ever so suddenly is not a proof of spontaneity, but of a favorable opportunity for it to manifest itself; the possibility had been there, and it may have been gathering force for a hundred generations, and just then got sufficient power to assert its right to be seen; or it may have been lying dormant awaiting a combination of favorable circumstances to call it into action.

Man originates nothing; what he does is to seize on a point when it appears—concentrate, consolidate and exaggerate it. Now if we could discover how these possibilities and liabilities to vary

got into the constitution of the organism, we would be in a position to answer one of the most urgent questions of the day in biology, and it might enable us to trace a connection with their remotest manifestations.

So, as an assistance in my effort "to see clear and think straight" on this subject, I have put my ideas in the following order:

Scientific investigation has extended our knowledge greatly on the origin of the individual, if not on the species; the authorities are now very full and clear on this point in the higher orders, and which is more or less applicable to all. They inform us that every new being originates from an egg or cell—animal and vegetable; egg, cell and seed, being interchangeable terms.

The order of nature, as a rule, is bisexual. That at the conjunction of the sexes there are a dozen possibilities or more on each side; that by a union of any two of these possibilities the life of an entirely new individual is originated, and generally the rest perish. That that individual, in its physical form, and its mental constitution, is but the latest manifestation of countless preceding generations. That it is likely to be most influenced by its immediate parent, but peculiarities of remote ancestors are liable to crop out in the most unexpected manner; that a change in the constitution of the parent produces a change in the egg. The eggs of a pure bred animal, when examined under a microscope, are found to be all alike, in type, form and vitality; in one cross-bred they are not all alike, and in the egg-mass of such, some can be found corresponding with those of a pure bred. That in-and-in-breeding of a particular type for generations results in such a fixity of that type that it becomes difficult to eradicate it; that by careful selection, elimination and rejection for generations, a type can be brought to such a degree of oneness in all its parts, that the character of the offspring can be predicted with absolute certainty. In cross-breeding this is impossible, and the more violent the cross the greater the uncertainty, and yet from such crosses some of the very finest types of their kind have been secured; by some fortunate combination they have reached a higher standard of excellence in some particular point than any of their ancestors ever attained to

These are now well attested facts brought to light by the study

of animals in domestication, and will act as safe and useful guides to us in the study of nature as well.

All life does not exist under the same conditions in nature. The habitable surface of the globe is immensely diversified; these diversities affect the life of the locality in some cases to such an extent that an expert can indicate the locality by its products. How it is accomplished has not yet been determined, but that it is accomplished requires no proof, as no one denies it. Geographical distribution asserts its right to consideration from every student of nature, but differences of opinion exist as to the amount of importance that should be attached to it as a cause of variation in nature, some regarding it as of little or no consequence, others as of the very highest importance. Of recent writers on the subject, one says, "no one can study organic life without being impressed with the great power of environment." Another speaks of the organic kingdom "lying plastic and passive in the hands of environment." Others insist on the influences of physical conditions as the cause of the origin of species. Some claim the influence of climate and temperature as the producing cause of specific change, whilst one asserts that "differences of specific value can only originate through the direct action of external conditions;" and yet another concludes, "that no power which acts only as a selective, and not as a transforming influence, can ever be put forth as an efficient cause of these changes."

Now, whilst accepting to the fullest extent all that can be claimed for the power of external conditions to produce change in organic life, I reject utterly this artificial, unscientific, and bewildering use of the term 'species.' A species is a set of forms that will commingle and produce fertile progeny, no matter how diverse they may be in appearance, all such different forms being varieties of that species. Hybrids, being uniformly infertile, such uniform infertility being proof that the parents were of different species, therefor these external influences are not making species, they are but rectifying existing ones. So I shall review the subject from this position.

All species had their origin in the past, just how far in the past it may not be possible to determine, further than to say—before man appeared. All species did not appear at the same time. Geology has made that plain to us. All naturalists are agreed that organic life in nature is in complete harmony with its environment, that is,

that the organism and the conditions in which it exists in nature are perfectly adapted, the one to the other. Now we are credibly informed that the conditions of the earth's surface were quite different in some of the periods of the world's history to what they are now ; so the life of these periods would therefore have been quite unsuited to the present conditions, just as the life of the present is wholly unfit for the past conditions. So then we infer that life appeared on this globe at such times as the conditions were ready to receive it, and in such forms as were suited to these conditions. Every form of life in the past being as perfectly adapted to its requirements, and as thoroughly in harmony with its environment as that of the present. Now the present diverse conditions of the globe's surface are as nothing compared with what the past conditions were, with what they are at the present ; therefore the disclosures of geology, that the forms of the life of the past were so different from those of the present, is the natural and necessary result of the vastly different conditions in which they lived.

The idea entertained by many, that at every change of the earth's conditions the previous forms were wholly swept away, and an entirely new set introduced, is contrary to the evidence and opposed to the requirements of the case. That new forms appeared on the scene long after others had been introduced, is quite evident, that they appeared conspicuously, and even suddenly, seems to be indicated, but that they also appeared whilst some at least of the previously existing forms were still there, seems to be satisfactorily demonstrated. The geological record clearly indicates that there has been no break in the stream of life from its first introduction to the present, but a steady, progressive continuity. Geologists inform us that they recognize some of the very earliest forms of life to be found in the rocks, as still living at the present day. Is it at all unlikely that there may be many more of the descendants of early forms still living that they do not recognize ? We know that some of the species of the present can change their location and accommodate themselves to altered conditions, and are modified thereby. May not many of the forms of life of the past periods in the world's changing conditions have succeeded in accommodating themselves to these changes, and been themselves so changed by them, bringing them into harmony with their surroundings, as to make it impossible now to recognize them ? The probability is, there is not a

solitary form on the face of the globe to-day identical in every particular with that in which it originated—not even man himself—all having been more or less subjected to the modifying influences of external conditions. This being the case, we have no means of knowing with certainty what any species may have been like when first originated; nor can we tell what kind of change would take place in an organism by a given change in its surroundings, that, as yet, is only known by observation, for we do not know what is the geologic and climatic chemical compound that constitutes the influence of any locality of the present, and far less of the past. So that if we would trace any species from its origin to the present, we must deal with the principles that are at work, and leave the form to the imagination. For a time, then, let us go back in thought to the first appearance of a pair of some species, on a continent with diverse geographical conditions. That pair would, no doubt, be in perfect harmony with its environment, in size, form, color and constitution; they would propagate and multiply, and in due time the progeny would fill the locality, then overflow into other localities, there in turn to repeat the process, and pass on until the continent was completely stocked with that species; but in their migrations they have come in contact with geographical conditions quite different from those they had left, which would act upon them and change their appearance more ro less, to bring them into harmony with their new conditions, so that we would have not only the land filled with the species, but we would have a number of local varieties of that species, each adapted to its own locality. Now as it is a migratory species we are considering, some of those varieties would in time return and get into localities already occupied by a different one, then cross-breeding would begin, with such consequences as we have already seen, when we would be likely to get several forms of the same species in the one locality, and some of these might be quite different from any of those that had hitherto appeared. I would just note here the principle of reversion, and the likelihood of permanent residence bringing a migrant into conformity with the native, more or less exact. Now suppose that this species had the power, or opportunity of getting to another continent, and continue its progress until it had encircled the globe, it would meet with more diversity of conditions to be yet more changed thereby. Then suppose some violent commotion took place, separating some portions

of the land from the rest, forming impassable barriers, and isolating some portions of the species from the others; this isolation would act exactly as in-and-in-breeding does in domestication, giving the influences of the locality time to work their utmost on the organism, giving a power and permanence to its peculiarity that would affect it for all time to come, and make it difficult to obliterate it, and stamping it with an individuality all its own. Now this isolation could have the effect of producing quite opposite results in the constitution of different organisms, for instance, if these barriers were, after a lengthened period of time removed, this form may have become so localized that it would be difficult or impossible for it to survive in greatly altered conditions, so that if it ventured beyond its own locality it would have a struggle to exist, or might perish altogether; or it may have been so enfeebled that it would be easily absorbed when it commingled with the forms of other localities; or it may be so strengthened that it would leave its impress on any other form of the species that it commingled with, or absorb them altogether; or its pecularities might have become so consolidated and fixed in its constitution that it could pass into any other locality and be but little, if at all, affected thereby. Now this is not merely an imaginary sketch, but a brief outline of processes that are actually going on, in part at least, at the present time; and there is good reason for believing that it has been gone through with fully by the ancestors of many forms of the present, and it may be even a hundred times in the life history of some of them. When once a species was introduced into the world, what seems necessary to make it a permanent resident for all time after, is a sufficient degree of elasticity in its constitution to enable it to accommodate itself to the altered conditions as they came upon it.

The forms of the past, as made known to us by the geological record, seem in great measure, to have perished by catastrophe: indeed I do not understand how in any other way than by a sudden removal of their remains from the disintegrating power of atmospheric influences, their forms could have been preserved to us at all. No doubt myriads of them perished in the ordinary course of events, that have not left the shadow of a shade to indicate to us that they have ever existed. Now, as no one catastrophe would be world wide then, any more than at present, so whilst numbers perished suddenly in one locality, numbers would be left alone

in another to continue the species; and as it is now held by the more advanced geologists that strata of the same kind were not formed all at the same time, but that when they were completed in one portion of the globe they might be only beginning to be formed in another portion, so that, although the effect produced by an overwhelming catastrophe in one portion of the globe might be felt to some extent over all its surface, its influence would be slight at first in the remoter regions, giving plenty of time for the life of these localities to accommodate themselves to whatever change in their conditions might result from it, if it was in them so to do. Take as an illustration of the idea which I wish to convey, the case of the Saurians. It is generally accepted that the Saurians of the present are the lineal descendants of some of those of the far past; although none of their forms which have been found are identical with any of those of the present. The geological record clearly indicates that there was a period in the world's history when the Saurians were the ruling power on earth. The conditions were no doubt particularly favorable for them: these are supposed to have been shallow seas of tepid water, an abundance of food, animal and vegetable, and an atmosphere surcharged with carbonic acid gas. They seemed to have fairly revelled in the luxuriance of their surroundings and increased in numbers, size and diversity of kinds amazingly. But a catastrophe overtook some of them, these were hermetically sealed and placed on the shelves of nature's museum, from whence we take and examine them at our leisure. Others escaped and went on their way for a time, but the conditions were beginning to change; slowly but steadily they were becoming less and less favorable for them and they could no longer continue their revelling. A real and genuine "struggle for existence" had for them set in with all its natural and necessary accompaniments, and many of the forms finding it too severe for them, gave up the struggle and disappeared from the scene. Some continued it for a longer period, but they too had to succumb to the inevitable and dropped out of view. Others, less particular and with more elasticity in their constitution, accommodated themselves to the evils of their lot, held on their course and made the best they could of it, whilst matters were still going on from bad to worse with them, until, in the present most unfavorable circumstances, all that is left of the royal race of Saurians of the past are a few ridiculous mendicants that existed by a confirmed habit of skulking and a

perverse tenacity of life, an unquestionable "survival of the most fit" for the condition, but a discredit to their ancestors and a disgust to the present rulers of the earth. They are getting scarcer every day, and when man has asserted his rightful dominion over every portion of the globe's surface, they too will have become extinct.*

Now, this I think, is applicable in some measure to the life of the past, in every era of the world's history. Away back in the primitive condition of the globe primitive forms emerged, suited to the then existing condition, these being in every way favorable, they prospered to the utmost. A change takes place that produces conditions less favorable to them. Another set of forms appear: better adapted for these conditions they succeed for a time, and the first has to occupy second place. Another change, and another set of forms comes to the front, whilst the second retires to take its place with the first; and yet another, and so on through the whole series, until man appears on the scene, whose duty and prerogative it is to change the whole face of nature and thereby assert his dominion over it. Each set of forms attaining their maximum when the conditions were most favarable and their minimum when they are least so, giving us an explanation of what appears like an anomaly in the life of the past: that the great forms should have preceeded the lesser of their kind and assuring us of the utter impossibility of their ever attaining like proportions again.

The causes producing these geologic and climatic differences which have appeared during the progressive history of this globe, would be a subject of intense interest and open up a field of investigation, limited only by the capacity of the individual investigating, but one that hardly comes within the scope of my subject, yet, if we could get a correct clue to it would lead us to a better understanding of the other.

The original elements composing this globe and all within the circle of gravitating force may be stated as earth, air, fire and water. These may be sub-divided indefinitely and their chemical constituents given in figures and letters. Now whatever changes took place in these during the protracted periods of time occupied in bringing this globe to its present condition, we may rest assured were not

* I am aware that some object to such a statement of the case; but it seems extremely probable that many creatures living at present may be in very much the same position of some men we read about who have outlived their usefulness.

brought about by any arbitrary enactment, but by the natural process of cause and effect, nor by any change in the laws of nature, nor by any addition made to the kind of materials through which these laws operated, but simply by a different combination of these that would produce quite different results.

I think we get an instructive view of one of the natural methods employed in making one stage of progress prepare the way for another in what is called the carboniferous era. This was characterized by a remarkable profusion of vegetation of a particular kind. For the production of this certain conditions were necessary, amongst others heat and an unlimited supply of carbonic acid gas, such as would be fatal to the animal life of the present. Now, whilst this vegetation was growing in rank luxuriance, the result of favorable conditions, it was also engaged in absorbing the carbonic acid gas from the atmosphere in vast quantities and retaining it. This was by some put under the surface of the ground, thereby making a permanent change in the condition of the atmosphere. This would deprive the descendants of that vegetation of the materials for growth in sufficient quantity, or in the required combination to produce like luxuriance, making a change in the character of the vegetation inevitable, and preparing the way for entirely different forms. This change in the vegetation of the period would have a powerful effect on the animal life of the same: some of the forms not being able to accommodate themselves to the change would perish, giving place to others that were better suited to the new conditions.

Now take into consideration the vast periods of time through which all this has been progressing—ages on ages roll; no hurry, but no delay. Change follows change—the destiny and doom of all matter—and the stream of life running parallel with it standing persistently, progressively, generation after generation come and go, living forms appear, perpetuate their kind, but to die and be resolved into their original elements, these to reappear in yet other forms, and go through the same routine—the true and real transmigration of nature. Then add to this the fact that during each and every one of these periods of time the geographical conditions were various, moulding and modifying the life of each, and that these living forms were given more or less to migrating, and consequently to a commingling of these and thereby multiplying their diversities, and making it possible for them to be yet greater and more numerous

and then consider if we have not got in all this a cause abundantly sufficient to account for all the puzzling and perplexing variations and modifications that we find in the species of the present day. It appears to me that the wonder ceases to be that they are so many, and the surprise comes in rather that their should be any stability left in any organism whatever, and I quite believe there would be none, but for the yet more marvellous power of hereditary transmission that holds every living form true to the species from which it came and from which it has not the power nor possibility of escape, and which alone makes classification possible.

Man produces his artificial varieties through his intelligent control of the natural laws of generation and propagation. Nature originates its varieties through the external influences of diverse geographical and geological conditions, and multiplies them by a commingling of these. Natural selection, as distinguished from artificial, begets promiscuous commingling of a species, and the power of environment produces the comparative uniformity in nature that we see. Natural selection, combined with external local influences, produces the local flora and fauna, which we can arrange, classify and systematize, and it is to a commingling of these diverse forms, producing a multitude of transmittable possibilities in the organization, that we may have to attribute many of those occasional and oft surprising differences that we find it so difficult to classify.

When contemplating any of the living forms of the present, and considering as to how it came to be as it is, we have to take into account not only its present existence and existing conditions, but also when and where it may have originated, the locality from which it may have come, and the direction in which it may have travelled. We have to think of the time that has elapsed since it was first originated, of the hundreds and thousands of generations which have come and gone since then, of the thousands of diverse influences that have encompassed and pressed in on every side in its onward course, moulding and modifying it in so many imperceptible and unsuspected ways. How it may have been held for thousands of years under one set of influences, and thousands of years under another, and as many more under a third, whilst during all these thousands of years it was mingling its diverse forms and producing yet more diversity, and this specimen which we are naming may be one of the last that has appeared in this seemingly interminable line

and may bear in its constitution and impress from each and all of these that may yet distinctly manifest itself in some of its offspring.

I regard this as a particularly profitable subject of investigation in many respects, but chiefly because it touches man at so many points. We get from it at a glance the origin of national characteristics. How differences and peculiarities at first sight were increased and intensified by environments, seclusion and non-intercourse, and how these are in the present day being softened and moderated, and are likely to get more so. It also gives us an insight into the origin of personal peculiarities—to that pronounced individualism that characterizes every free community—and how this is likely to increase and become yet more marked and observable. In it also we find an explanation of what appears a puzzle to many, the complete uncertainty as to what may be the development from any given union, and the sometimes startling differences seen between the parents and their children and the oft expressed surprise that these do not always come up to the standard of the parents.

The question is often asked, "Cannot man be improved as well as his domestic animals?" I reply, most assuredly he can, if the same methods were followed to secure the same result, and these are all summed up in three words: selection, elimination and rejection.

Wallace has said that "So far natural selection has done nothing for man." Well, I suspect that is just about as much as it has done for anything else. Let anyone cbserve nature and its methods and they will soon be convinced that this is not the direction to look for progressive improvement. Its whole tendency is toward uniformity, and uniformity is not favorable to progress. Human history is a runniug commentary on this great truth. Progressive improvement for man has come so far, principally through the external influences of education, cultivation and refinement; but these seem to work very slowly and with great uncertainty. An Italian once sarcastically remarked: "Who knows but one of these days a powerful microscope may detect globules of nobility in the blood." We have seen that the microscope has been more scientifically used, and with what results. Edmond About, when commenting on that quotation, said: "I am too French not to enjoy a joke, but I confess 'globules of nobility' does not offend my reason." We know that dogs are slow or fast, keen scented or keen sighted,

according to their breed, and we buy a two-year colt on the strength of its pedigree.

Can we consistently admit nobility among horses and dogs and deny it among men? I reply, if the same methods are not adopted to secure it we have no right to look for it. True, individual specimens of humanity will occasionally appear, with an innate nobility in mind, mien and form, that compels acknowledgment from all who come in contact with them, where no design was used to secure it; but it is not permanent in their line, as is the case where selection has been carefully attended to. This is the kind of occurrence that is unscientifically called 'accidental,' but would be termed among breeders of stock, if appearing there, as 'a fortunate hit,' from a want of a knowledge of the combination of causes that were at work in producing it.

One irreverent scribe has gone so far as to say, "there is no other such mongrel breed on the face of the earth as man, and that a large portion of the present scrub race should never have been born, and have no right to be allowed to transmit their deficiencies." This is going to the root of the trouble with a vengeance. Will the time come when a free people, in their zeal for the improvement of the race, shall demand the appointment of a governmental inspector of marriage-matches, upon whom shall devolve the responsibility of selecting, eliminating and rejecting? Then we would be warranted in effecting a steady improvement of the race, in appearance at least; but this would in the course of time lead to uniformity. Now there can be no doubt that a genius is the result of some fortunate combination of diverse elements, and as one genius is of more importance to the world's advancement than a thousand common-place individuals, can we afford to run the risk of loosing our geniuses for the sake of a general uniform rise in the standard of the race? But more, we know that man can improve his stock out of existence; when he has got any one of his organisms up to about the point of perfection, he finds that its constitution has become so enfeebled that it is necessary for him to fall back on cross-fertilization to secure its continuance. So in this, as in many other things, we may find it better to endure the ills we have than fly to those we know not of.

ANTIQUARIAN AND GEOLOGICAL NOTES, No. 1.

Read before the Hamilton Association, December 12th, 1889,

BY COLONEL GRANT.

In 1862, when quartered with the 2nd battalion of H. M. 16th Foot, at the Curragh of Kildare, Ireland, I obtained from a gravel pit in rear of "The Lines" a fine, well-preserved specimen of a round flat, rather sharp-edged, stone Disk—deeply grooved on one face, while a similar groove presented itself on the opposite, running at right angles. It was taken from apparently undisturbed gravel, a few feet below the clay overlying the bank; that it was fashioned by the hand of man seemed plain enough. How did it come there was the only difficulty to solve, and I came to the conclusion that a Palæolithic Warrior had been interred there. Human or other bones for that matter are invariably ill-preserved in "gravel" or "sandy soil," and when the body underwent the process of decomposition, the water-rounded pebbles and sands above would naturally fall and fill the vacancy beneath, (perhaps a close search might have revealed flint arrow points and stone celts also.)

The specimen I obtained could scarcely have been "the Leiagh-lama-liagh," (champion hand-stone) described by the Irish scholar and antiquarian, Eugene Curry. Massive, it certainly was not, but propelled from a sling perhaps it would have been as efficient a weapon as in after time, "When the Slingers of Laney forced the Norman De Bourghos to flee."

Grooved oval disks, it is said, have also been found on this continent.

The gravel pits at the Curragh contain many fossiliferous pebbles of the carboniferous (mountain limestone mixed with granites) Porphyries, etc., derived probably from "The Wicklow mountains" adjacent. I have not seen the report on the surface geology of the district, and therefore may erroneously suppose the gravel beds to be a glacial or inter-glacial deposit.

If the alleged discovery of Mr. Skertchley, an officer of the English Geological Survey, can be clearly demonstrated, viz: finding flint implements in beds formed before the close of the glacial period at Brandon, Suffolk, it may be doubted whether my stone implement may not be of far greater antiquity than was at first supposed.

Referring to Mr. Skertchley's find, a correspondent of the *London Times* states, "One implement was picked out of the beds in a pit at Culford, Suffolk, two others were dug out of like beds at Botany Bay, on the Norfolk side of Brandon. It was not until Mr. Skertchley himself found another implement at Culford, and saw the boulder clay above the beds from which he extracted it, that the importance of the discovery dawned on him.

Alongside "the Culford implement" he found a deposit of broken and scraped Mammalion bones and "fresh water" shells; these bones were all in a circumscribed area. Underneath the bones the clay was found to be burned. Mr. Skertchley's explanation is that we have here preserved the solitary instance in the whole world of a camping ground of Palæolithic men, and the camping ground occurred below the boulder clay which belonged to the earliest part of the *glacial period.*

In the coal shale of Wezicon, Switzerland, it is said a series of pointed fir poles, covered with wicker-work, have been found; they are supposed to be the most ancient evidence of the existence of man, and belonging to the period intervening between the two glacial epochs.

I am aware that a still greater antiquity is claimed for man on this continent. Professor Whitney supposes the now famous Calaveros Skull (found in auriferous gravels in the West) to be of the Pliocene age; but a recent writer, Professor H. Haynes, well remarks, "In the Pliocene age we cannot expect to find traces of man upon the earth, as the living placental mammals had only then begun to appear." Has not this still greater force when applied to the Miocene, a yet older age. The recent origin of man has been well urged, says Sir William Dawson, by Le Coute: "Some Mesazric protozoa still survive, so do many tertrary mollasks, but the mammals are of much less duration. No living species goes back further than the 'Pliocene,' few extend further than the 'Glacial' age."

It is asserted that many of the flint implements discovered in New Jersey and other places in the "States" were obtained from superficial gravels, (not true glacial drift). I noticed some years ago, part of the rib of a Mastedon (probably) in a "Slab-town" gravel pit; but as yet I failed to procure any flint or other implements either there or at Burlington Heights. It was in making the excavation for the Desjardin's Canal that the bones of a mammoth jaw of a Beaver, and horns of the "Wapiti" were found. Although the Canadian Geological Survey, in Sir William Logan's time, noted that the Erie clays *underlie* the gravels, Burlington Heights, at the Desjardin's Canal, I can find no record of their *overlying* our local glaciated chert on the Niagara escarpment here. This circumstance probably escaped observation. I think it has an important bearing on the ill-understood superficial geology of this district.

The clay containing rounded transported Laurentian pebbles, fills up the grooves made by glacial action, and can be easily distinguished from the mere surface soil above it. I have placed in one of the side cases of the Museum a specimen for examination.

NOTES ON THE HISTORY OF BOTANY.

Read before the Hamilton Association, March 13, 1890.

BY T. J. W. BURGESS, M. B, F. R. S. C., ETC.

My contribution for your consideration this evening, entitled "Notes on the History of Botany," is indeed but a few brief notes on the subject. To prepare anything like a complete history of this charming science, is a task far beyond my ability, and, even were I able to execute it, so extensive is the subject that the listening to it would occupy, not an hour or two, but night after night of your valuable time.

In every age, in every clime, flowers have ever been regarded as among the most beautiful of the varied works of creation. Scarce a poet but has sung of their beauties—not an artist but has attempted to depict their gorgeous colorings. The sculptor and the architect have sought to render them imperishable in stone, and novelists have woven some of their tenderest fancies about them. Who has not read that sweetest of stories, "Picciola?" How the leaves of the little flowret, stretching themselves between the harsh prison stones, carried a message of truth and beauty, spoke of mercy and grace, to a despairing soul. Flowers are entwined about our lives, and from the earliest times they have been represented in the social and religious ceremonies of most countries. Children greet them with shouts of joy; to the bride they are a fitting emblem of a happy future; and at the tomb kind friends deposit them on the bodies of departed loved ones. Numberless are the lessons to be learned from these beautifiers of the earth, which smile alike upon the peasant and the peer, which bloom equally for the abode of poverty and the home of unlimited luxury. Every herb, ever shrub, every tree is full of interest; not a plant but has some peculiar beauty or some exquisite adaptation.

"Your voiceless lips, O Flowers! are living preachers,
Each cup a pulpit, every leaf a book,
Supplying to my fancy numerous teachers
From lonliest nook."

So sang the poet Horace Smith, and not less sweetly or truthfully did the Scotish minstrel, Allan Cunningham, write:

"There is a lesson in each flower,
A story in each stream and bower;
In every herb on which we tread
Are written words which, rightly read,
Will lead you from earth's fragrant sod
To hope, and holiness, and God."

Viewed even by the critical eye of science, Botany presents many attractions unknown to the other branches of Natural History, and well deserves the appellation of our French cousins, "la belle science." To the history of this most charming of studies I would now call your attention.

Botany, derived from a Greek word meaning a plant, is the natural history of the vegetable kingdom. In its widest sense it embraces everything respecting plants—their nature, their kind, the laws which govern them, and the uses to which they may be applied in medicine, chemistry, or the arts in general. As, however, their medical virtues fall most properly under the province of the physician, their chemical properties under that of the chemist, and their various other qualities, beneficent or otherwise, under different departments of the scientific world, it is commonly restricted to a knowledge of the plants themselves, their mode of growth, their anatomical and physiological phenomena, and those characteristic marks by which the various species may be distinguished from one another. It is only within comparatively recent years that, in this sense, the science of botany has been developed, its great misfortune having been that, from its very inception, it was looked upon merely as an adjunct to medicine. This was the reason why our ancestors sought only for healing virtues in plants, whilst a knowledge of the plants themselves was totally neglected. Botany, as a study, was nothing, and those among the ancients, who prided themselves most on their acquaintance with plants, had no idea of their structure or the relation borne by one class to another. They knew, perhaps, by sight a few of the plants of their own neighborhood, to which they gave names at random, and to which they attributed wonderful virtues from some fancied good resulting from their use in various ways. These same plants had different names in every state and country then known, and those who adopted them in their paniceas,

at most gave them only the name by which they were known in their own immediate vicinity. A dozen names were often given to the same plant, and the same name to a dozen plants. The confusion resulting from this arbitrary bestowal of names can be imagined. When a recipe travelled into a new locality it was no longer known what plants composed it. Everybody substituted in the mixture or ointment, as the case might be, another plant after his own fancy, but, to keep up the sale of it, gave it the same name, so that in a short time all trace of the original plant was lost. A relic of this barbarism remains even to this day in the numerous cases we have of the same common name applied to plants the most diverse, a notable instance of which exists in the term Mayflower, affixed to at least half a dozen different plants in as many different orders. For example, the Trailing Arbutus *(Epigæa repens)*, the Spring-Beauty *(Claytonia Virginica)*, and the June-Berry *(Amelanchier Canadensis)*, are all known by this title in different localities, a fact which has led to no little disputation in the effort to establish what plant was originally so called by the New England Loyalists. Probably, at this period, some good observations, which deserved not to have been forgotten, were made, but, amid such a chaos of nomenclature, those who made them had no possible means of communicating or recording them in a recognizable style. The result was that there followed endless disputes upon words and names, every useful enquiry and description being lost for want of the disputants being able to decide what plant each observer had really referred to.

Not content with such a mixing of names and terms, these earliest botanists, or more properly herbalists, drew largely on their imagination for properties in plants, or greatly exaggerated any slight virtue they actually possessed. Their object in this was, most likely, the filling of their pockets at the expense of their dupes, for quacks existed in those days as well as in our own. However, be their reason what it might, the fact remains that, through such deceptions, many marvellous beliefs about plants arose and were handed down. Most of these, viewed in the light of modern philosophy, are truly laughable. Thus, Xanthius, the historian, tells us that a man killed by a dragon can be restored to life by a herb, which he calls *balin*, and Democritus gravely asserts that there is a plant, the juice of which applied to a wedge will cause it to

spring out of the tree into which it has been driven. Again, Vitruvius, speaking of the virtues of Spleenwort *(Ceterach Officinarum)* as regards its reputed action on the spleen, says that in the island of Crete, on the side toward Cortyna, the flocks and herds were found without spleens because they browsed on this herb, while on the other side, toward Gnosus, they had spleens because it did not grow there. Such superstitions continued through the days of the Roman Empire, were very prevalent during the middle ages, and remnants of them still exist, especially in country districts. How fixed was the belief in the magical properties of certain plants, may be judged from the following lines by Virgil, written, not in a strain of poetic, fervid imagination, but of sober earnest:

> "These poisonous plants, for magic use designed,
> (The noblest and the best of all the baneful kind),
> Old Mæris brought me from the Pontic strand,
> And culled the mischief of a bounteous land.
> Smeared with their powerful juices, on the plain
> He howls, a wolf among the hungry train:
> And oft the mighty necromancer boasts
> With them, to call from tombs the stalking ghosts."

Later, we find Culpeper, in his herbal published in 1653, saying of Moonwort *(Botrychium Lunaria)*: "Moonwort is an herb which will open locks, and unshoe such horses as tread upon it, and country people that I know call it 'Unshoe the Horse.' Besides I have heard commanders say, that on White Down in Devonshire, near Tiverton, there was found thirty horse-shoes pulled off from the feet of the Earl of Essex his horses being there drawn up in a body, many of them being but newly shod, and no reason known." Numberless further examples of the superstitious belief in the magic power of plants might be cited, but I must pass on to the history of botany proper. This, for convenience of description, I shall divide into four great epochs, calling them the Ancient, the Arabian, the Artificial, and the Natural Epochs.

The Ancient Epoch embraces the period between the creation of the world and the destruction of the Western Empire by the Goths and Vandals, which races, cradled in war and rapine, hated science, believing it caused effeminacy in its devotees, and would not allow their children to cultivate it. The earliest known mention of plants is in the Book of Genesis, where it is recorded by Moses that, on the

third day God said: "Let the earth bring forth grass, the herb yielding seed, and the fruit tree yielding fruit after his kind, whose seed is in itself, upon the earth; and it was so." It is also recorded that Adam gave names to all the beasts of the fields and fowls of the air, and the "Blind Bard" Milton, in his "Paradise Lost," has beautifully and poetically ascribed a similar task to Eve regarding the flowers, making her exclaim, in her lamentation on quitting the Garden of Eden:

> "Oh flowers,
> * * * * * * * * * *
> * * * which I bred up with tender hand
> From the first opening bud, and gave ye names."

Throughout the Bible we find numerous allusions to trees and herbs, and Solomon, it is probable, wrote a treatise upon the subject, for in the Book of Kings it is said of him: "He spake proverbs and songs; he also spake of trees, from the cedar-tree that is in Lebanon, even unto the hyssop, that springeth out of the wall." Anything he may have done in this way, however, is totally lost. Anaxagoras, Pythagoras, and other ancient Grecian philosophers also wrote upon plants, but their works have shared the same fate, and the poems of Homer, in secular literature, afford us the only vestiges of the botanical knowledge of the earliest ages.

Aristotle included the vegetable kingdom among his numerous subjects of study, and considered plants as intermediate between unorganized matter and animals. Although we know that a treatise on botany was issued among his other writings on Natural History, about 384 B. C., all trace of it having disappeared, we may say that the proper historical era of the science begins with his friend and disciple Theophrastus, who, about 300 B. C., published a History of Plants in ten books, only one of which, however, is now extant. In this he treats of the origin, propogation, and anatomy of plants, describing about five hundred species, which are divided into classes with respect to their generation; their place of growth; their size, as trees or shrubs; their use as culinary herbs and esculent grains; and their juices.

Nearly three hundred years after the time of Theophrastus, or about the beginning of the Christian era, another Greek, Dioscorides, travelled over Asia Minor and Italy, studying plants, of which he gives the names and properties of about six hundred, arranged in four classes, according to their uses; viz., aromatic, nutritious,

vinous, and medicinal plants. Nearly contemporary with Dioscorides were Cato, Varro, and Virgil, who wrote on agriculture and rural economy.

Following these worthies came the elder Pliny, who, in his fifty-sixth year, became the victim of his curiosity for enquiry, while attempting to witness an eruption of Vesuvius. He devoted sixteen of the thirty-seven books comprising his " History of the World " to plants. Besides enumerating the discoveries of Theophrastus and Dioscorides he described many new species, bringing the number up to above a thousand. Like the other ancient botanists though, Pliny admits, with little or no distinction, truth and error, useful knowledge and absurd fable, which fact, together with the want of a proper systematic arrangement, renders it impossible to determine which are the plants he described.

With Pliny closes what I have called the Ancient Epoch of Botany, for after his time, its study rapidly declined, and ages of darkness and lethargy succeeded.

The second, or Arabian, Epoch of Botany began during the eighth century, with the reappearance of the elements of ancient plant lore among the Saracens. This barbarous but noble race, who had formerly shown their contempt for science by the wanton destruction of the magnificent library of Alexandria, at this time became imbued with a love of it, chiefly by contact with the many enlightened men, who, banished by the Emperor Theodosius, had found refuge amongst them. A succession of Caliphs, most notable of whom was the famous Haroun Alraschid, by their fostering care of learning and learned men, made Bagdad the most enlightened city in the world. Serapion, well known in medicine, stands first on the Arabian catalogue of botanists, and was followed by Rhazis, Avicenna, Averhoes and Actuarius, while Plato Apuleius, of whose herbarium very old manuscript copies are still preserved, is supposed to have lived about this period. These men discovered many plants of Persia, India and China, which were unknown to their predecessors, but unluckily they thought less of observing nature and chronicling their own observations, than of translating and commenting on the old Grecian writers. In consequence, their descriptions of plants are imperfect, and, for want of a systematic arrangement and comprehensive nomenclature, generally unrecognizable. If, however,

they did little to advance the science, they at least kept alive the love of it, and vigilantly watched over the intellectual treasures of antiquity, translating the works of the ancients and introducing them into their schools.

Early in the eighth century, the Moors, who had made themselves masters of northern Africa, induced by the representations of the traitorous and apostate Count Julian, crossed the straits under the command of Taric ben Zeyad, or, as he was known to the Spaniards, Taric el Tuerto, or Taric, the one-eyed. Seizing the rock of Calpe, this doughty chieftain fortified it as a stronghold, changing its name to Gibel Taric, or the Mountain of Tarib, since corrupted into Gibraltar; and by his defeat of Don Roderick, last of the Goths, on the banks of the Guadalete, ended the Gothic power, which had remained unshaken in Spain for two and a half centuries. The subjugation of the whole peninsula was speedily completed, and the elements of botanical science, as known to the Arabs, soon spread to France, Italy, Germany, and England. Abenguist, a famous Saracenic physician and botanist, flourished about the end of the twelfth century, and superiority in the sciences was preserved by the Arabians until toward the close of the fifteenth. But when, in 1492, this wonderful people, gradually divested of their European conquests, lost their last foothold in Spain by the fall of Granada, they seemed at once, with the departure to Africa of the the last of the Moorish kings, Boabdil el Chico, to replunge into that savage ignorance from which they had so brilliantly emerged.

Arrived now at the beginning of the sixteenth century, we enter upon the third great botanical epoch, which I have called the Artificial, being the period during which the artificial arrangement of plants flourished, a period adorned by such names as Cæsalpinus, Morison, Ray, Tournefort, and, greatest of all, the immortal Linnæus.

An artificial classification differs from a natural one, in that the former singles out one or more points of resemblance or difference, and arranges by them without reference to other considerations, convenience and facility being the controlling principles. On the other hand a natural system aims to arrange all known plants into groups according to their resemblances and their degrees of resemblance, so that each species, genus and order shall stand next to that which it most resembles *in all respects*, or rather in the whole plan of structure.

In other words, an artificial system arranges plants on a certain part, or parts, of them, while a natural one takes all the parts into consideration.

The initial point of this epoch was the arising of greater independence of thought concerning ancient writers. Men began to say—we have been looking everywhere for the plants of Theophrastus, Dioscorides, and Pliny, whereas they did not know a tithe of those covering the earth. What foolishness to endeavor to apply to the plants of one's own country, France, England, etc., as the case might be, the names under which these men described those of Greece and Asia, without knowing whether they are the same. We must explore each country, and collect, examine and compare the plants of the one with the other, for then only will we be in a position to distinguish them.

About 1536 the first botanical garden of modern times was establish in Italy, on the banks of the river Po, by Brasavola, but to the Germans belongs the honor of being the first to publish books founded mainly on *actual observation*—Otto Brunfels, of Mayence, having issued such a work in 1530. It also contained the first cuts, but, as Willdenow remarks: "The drawings are not very good, and do not in the least correspond with his own descriptions." To Germany is also due the credit, in the Herbal of Jerome Bock, published 1532, of producing the first botanist, who replaced the old alphebetical order, in which plants had always been hitherto described, with an arrangement depending on their natural resemblances, that is the likeness which may be observed by the most unscientific persons in their general forms and characters. Crude as was his work it introduced a new principle which had the greatest influence in promoting the advancement of systematic botany. Up to this time botanists had blindly followed the ancient writers in classifying plants by their roots, herbage, time of flowering, place of growth, medical or economic uses, and other arbitrary distinctions, and it was not till about 1560 that Conrad Gesner, of Zurich, in his "Historia Plantarum," first suggested the existence, in the vegetable kingdom, of groups, or genera, each composed of many species united by similar characters of the flower and fruit. Gesner did not, however, establish any plan founded upon this principle, but, having formulated the idea, left its first application to Dr. Andrew Cæsalpinus, a physician of Pisa, Italy, who, in a work published in Florence, in

1583, proposed to form species into classes, and thus originated systematic botany. The characters which he employed for this purpose were the duration and size of plants, the presence or absence of flowers, the number of cotyledons, the situation of the seed, the adherence of the pericarp to the seed, the number of cells in the paricarp with the number of seeds in each of these cells, the adherence of the calyx to the germ, and the nature of the root, whether bulbous or filrous. This method was too imperfect to be adopted, however, and for nearly a century no one appeared to follow in the path which Cæsalpinus had opened. During this interval though, the science was gradually improved in its details, Clusius teaching botanists to describe accurately by discarding superfluous terms without the omission of any important characteristic, and the brothers, John and Caspar, Bauhin adding to their respective works a synonymy, or exact list of the different names which all previous writers had applied to the same plant. In the same period, too, flourished a number of other and less illustrious authors, some of them chiefly notable for the useless or laughable systems they proposed, to wit.: Du Pas, a Frenchman, suggested an arrangement of plants by their time of flowering, and Porta, an Italian, one from their relation to the stars, to men, and to other animals.

In 1680, Robert Morison, a native of Aberdeen, Scotland, and Superintendent of the Botanic Gardens at Oxford, revived and carried into practice the principle of Cæsalpinus, in his great systematic work, "The Universal History of Plants." Morison sets out with the division of plants, from their consistence, into ligneous and herbaceous, and founds his system on their fruit, blossoms, and habits. Two years later, John Ray, of Trinity College, Cambridge, proposed another system of classification in his "Methodus Plantarum Nova," a work amended and completed in 1703. He divided plants into thirty-five classes, formed on their habits and external appearances, their greater or less degrees of perfection, their place of growth, the number of seeds, petals or sepals to the flower, and the kind of fruit or infloiesence. The great merit of Ray's system was his division of herbs into flowerless and flowering, and the latter into dicotyledenous and monocotyledonous; its great fault the primary division of plants into trees and herbs. This division of plants into trees and herbs, referring the larger shrubs to the former the under-

shrubs to the latter, had been adopted by every botanical writer since the days of Aristotle, and by its antiquity had gained an importance to which it was by no means entitled. The first to note the great demerit of such a primary division, from its uncertainty and repugnance to the spirit of system, was Augustus Rivinus, Professor of Botany at Leipsic, who, eight years after the first publication of Ray's system, that is in 1690, discarded it and proposed a classification based wholly on the corolla.

Knaut, Herman, Bœrhave, Ruppius, and Ludwig were also prominent botanists of this, the seventeenth, century, but the next after Rivinus to advance a leading system was Joseph Pitton de Tournefort, a native of Provence, and Curator of the Jardin du Roi. Tournefort travelled through Spain, Holland and the East, collecting extensively, and published his method of classification, "Elements of Botany," in 1694. It was more definite but more artificial than that of Ray, being based, like Rivinus', almost wholly upon modifications of the corolla, but unfortunately it revived the old division of plants into trees and herbs, which the latter had so wisely discarded. Its great advance over previous systems was, that in it, genera, as we now understand them, were first established and defined, all the species then known being referred to them, so that, in one sense, Linnæus was right in calling Tournefort the founder of genera.

Many authors of note followed the lead of Tournefort, including Jussieu, Vaillant, Petit, Vallentin, Dillenius, Linden and Sloane, but it was not until 1735 that Linnæus, suddenly emerging from obscurity, offered to the world a system of botany so far superior to all others as to leave no room for dispute as to its comparative merit. Karl Linne', or, as he is more commonly styled, Linnæus, was born on the 23rd of May, 1707, at Rashult, in Sweden. His father, a clergyman, had designed his son for the same sacred calling, but the boy's teachers seeing him pay less attention to Hebrew and theology than to the study of natural history, advised him to apprentice him to shoemaking or some other trade, as being quite unfit for any of the learned professions. Happily for the progress of science this advice was not acted upon by the disappointed parent, who, instead, accepted the offer of one Dr. Rothman, Professor of Medicine in the College of Wexio, to give him an education preparatory for his entering his own profession. For some time after

his matriculation at the University of Lund, in 1727, young Linnæus' struggle was a terribly uphill one. His endeavor to pursue both his botanical and medical studies, while relying for support on the instruction of private pupils, made his circumstances almost desperate. His father was too poor to do anything more for him, and he was often indebted to his fellow-students for an occasional meal or cast-off garment. In 1729, however, just when his fortunes were at their lowest ebb, he was engaged by the Rev. Olaus Celsius, one of the Professors at Upsal, to help in a work he was preparing, illustrative of Bible plants.

A small work of Vaillant's, on the structure of flowers, now fell into his hands, and from the ingenious remarks of that writer on the existence of sex in plants, he conceived the idea of a system of botany founded on the stamens and pistils, a system on which were arranged nearly all his subsequent botanical contributions. About the same time a short treatise which he had composed, attracted the attention of Rudbeck, Professor of Botany, who, being old, was desirous of obtaining a competent assistant, and he assigned to him the office of demonstrating plants in the botanic garden, giving him also free access to his fine library. The clouds of poverty and obscurity were thenceforth gradually dispelled, and Linnæus became known to men of talent as a rising genius. In 1731 he was sent by the Royal Academy of Sciences at Upsal to investigate the natural history of Lapland, the results of which expedition he afterwards published in his "Flora Lapponica." In 1734 we find him acting as travelling tutor to the sons of Baron Renterholm, and in 1735 setting out to take his degree as doctor of medicine in Holland, where it could be procured at much less expense than in Sweden. While in Leyden he called upon the celebrated Dr. Gronovius, who, returning the visit, saw the manuscript of his "Systema Naturae," and was so astonished and delighted with it that he requested Linnæus' permission to get it printed at his own expense. The Dutch botanists received the work with the utmost cordiality, and immediately embraced and adopted the system, which was further amplified by the publication of the "Genera Plantarum." Linnæus next, in succession, visited England, where he made the acquaintance and secured the friendship of Sir Hans Sloane and the learned Dillenius, and France, where the Jussieus, uncle and nephew, showed him every courtesy. Returning to Sweden he settled in Stockholm

to begin the practice of his profession, and in 1739 married a Miss Moræus, to whom he had been long engaged, but whom he had previously been prevented marrying by his straitened circumstances. Soon after he was appointed to fill the chair of natural history in the Upsal University, and his great fame and extensive correspondence enabled him to enrich the academic gardens with an immense variety of plants. Jussieu and Van Royen sent him those of India, Haller and Ludwig European ones, and Collinson and Catesby specimens from the New World, while his pupils Thunberg, Hasselquest, Kalm, Osbeck and others gave him details and material from their travels in Europe, Asia, Africa and America. Riches now flowed rapidly in upon him, and in 1757 he was elevated to the nobility, taking the title of Von Linné. This speedy rise to wealth and honors did not, however, in anywise diminish his assiduity in study, and an extraordinary number of works were completed in various departments of natural history, all evincing the same clearness of ideas and precision of language which have made his writings so especially valuable. Toward the close of his life, Linnæus, who for many years had enjoyed excellent health, was attacked by apoplexy, which, in some degree, impaired his mental powers. The first attack occurred in 1776. In the succeeding year he had a second stroke, and, after a lingering illness, died on the 10th of January, 1778, in the seventy-first year of his age. A general mourning of the nation followed, while the king, Gustavus III., in a speech from the throne, alluded to his death as a public calamity, and ordered a medal to be struck expressive of the national grief at his loss. The best idea of the marvellous ability of this great man is gained from the title by which he has been honored by the scientific world, a far prouder one than any mere hereditary distinction, that of "Prince of Naturalists."

Linnæus' greatest work, the "Species Plantarum," which Haller has emphatically termed "Maximum opus et aeternum," appeared in 1753. To this all his other botanical productions were in some measure only preparatory.

The Linnæan or Sexual System is, briefly, as follows. All known plants are divided into twenty-four classes, the characters of which are formed on the number, or difference in situation or arrangement, of the stamens. The names assigned to these classes are of Greek derivation, and express their several distinctions, *e. g.*, Mon-

andria, Diandria, Triandria, etc Stamens and pistils exist in all the classes except the twenty-fourth, which embraces the Cryptogamia. The orders are founded, as far as possible, on a similar number, situation or arrangement, of the pistils. The strongest recommendation and the sole aim of the Linnæan artificial system was to help anyone to learn the name and history of an unknown plant, in the most easy and certain manner, and even after the recognition of the natural system, it was customary to prefix it to Floras as a key to the genera. It stands unrivalled as a convenient artificial classification of plants, and the impetus its introduction gave to the study of botany throughout the civilized world is without a parallel. Although its classes and orders have passed away, the Linnæan genera and species have stood the test of time most wonderfully, a fact owing to the remarkable exactness of the great author's descriptions, as well as his keen preception of the true relationships of plants.

Not least among the wonderful works of Linnæus was his introduction of a binomial nomenclature, or the method of distinguishing every plant by only two words. Prior to his time a whole sentence was often required to express the name of a plant, and to such a length had many of the names grown that had it continued the study of botany must have been abandoned from its mere unwieldiness. The terrible labor of handling these long names may be judged from the following extract from a letter of Dillenius to Linnæus.

"In your last letter I find a plant gathered in Charles Island, on the coast of Gothland, which you judge to be Polygonum erectum angustifolium, floribus candidis of Mentzelius, and Caryophyllum saxatilis, foliis gramineis, umbellatis corymbis of Bauhin ; nor do I object. But it is by no means Tournefort's Lychnis alpina linifolia, multiflora, perampla radice, whose flowers are more scattered and leaves broader in the middle, though narrower at the end."

The poor plant, the object of all these opprobrious epithets, seems to have been *Gypsophila fastigiata*, L., a Swiss plant of the order Caryophyllaceæ.

Linnæus himself did not at first perceive the great value of a binomial nomenclature, and in his early works he distinguished species by the long explanatory phrases of the older botanists ; thus, in his "Flora Lapponica," he names a violet, "Viola foliis subro-

tundis cordatis pedunculis radicatis," which translated would make the name of the plant, the violet with long-peduncled, subrotund, cordate root-leaves. This unwieldy title for the common European marsh-violet, he afterwards, in his "Species Plantarum," where he first used, as he terms them, *trivial* names, converted into *Viola palustris*, the name it still bears.

With Linnæus I will close what I have named the Artificial, and enter on the Natural epoch of botany, for though his system of classes and orders held sway for nearly a hundred years, and some of you probably studied it in one or more of the numerous authors who copied him, yet, even before his death, there had begun to spring up the natural system which is now in use. That Linnæus himself recognized the importance and superiority of such a system we know by the following extract from one of his letters on the subject to the celebrated Professor Haller of Gottingen.

"I have never spoken of my sexual system as a natural method; on the contrary, in my Systema I have said, 'No natural botanical system has yet been constructed, though one or two may be more so than others; nor do I contend that this system is by any means natural. I do not deny that a natural method is preferable, not only to my system, but to all that have been invented. Probably I may, on a future occasion, propose some fragments of such a one. Meanwhile, till that is discovered, artificial systems are indispensable.'"

This expressed intention to attempt a natural classification was carried into effect by an effort to group the known genera under sixty-seven natural orders, Piperitæ, Palmæ, Amentaceæ, etc., but was afterwards abandoned.

The problem was taken up by a contemporary and correspondent of Linnæus, Bernard de Jussieu, a Frenchman and curator of the Royal Garden at Trianon, who, however, left nothing in writing but a bare catalogue of the gardens, and it was left for a pupil of his, one Michael Adanson, a native of Provence, to first publish, in his "Familes des Plantes," 1763, a complete system of natural orders. Under this system one class consisted of all plants with similar roots, another of all with similar stems, and a third of all with similar leaves as regarded form and situation, but the most important distinctions he considered as founded on the organs of fructification. The system of this ingenious botanist, whose name is pre-

served in the Adansonia or Calabash tree of Africa, was so cumberous and had such a barbarous nomenclature that it never found many supporters, and the fame of being called the founder of the natural system of botany has fallen to Antoine Laurent de Jussieu, to whom more than any other person the honor may be ascribed. This Jussieu, who was born at Lyons, France, in 1748, was the nephew of the Bernard de Jussieu mentioned before, whose pupil and assistant he became when still a youth. Like most of the distinguished early, and indeed later, botanists, this great genius had adopted the profession of medicine, to which even yet botany was only considered an accessory science, and the first few years of his life in Paris were devoted to the study of it. Afterwards appointed demonstrator of botany at the Jardin du Roi, now the Jardin des Plantes, he thenceforth gave his entire time and energy to his favorite science, and especially to the conditions necessary to the formation of a natural system. After nineteen years patient labor he published, in 1789, his "Genera Plantarum Secundem Ordines Naturales Disposita," in which one hundred natural orders of plants were first established and defined by proper characters, nearly all known genera being arranged under them. His primary division of the vegetable kingdom was into Acotyledones, Monocotyledones, and Dicotyledones, which were again subdivided into fifteen classes. The reception accorded to the system of Jussieu was not nearly as cordial as to that of Linnæus, the two systems being regarded as rivals, and many works were published endeavoring to show that the method of the former was not more natural than the Linnæan, while inferior as an artificial one.

The next great systematist was Augustine Pyramme de Candolle, another member of the medical profession, who was born at Geneva, in 1778, a year made memorable by the death of Linnæus, an event which occurred only about three weeks before the birth of one who stands only second to him in the same department of science. In his "Principes de Botanique" prefixed to the "Flore Francaise," published in 1805, he reversed the order of Jussieu, which proceeded from the lower to the higher forms of vegetable life, and began with the latter. On account of its convenience this order has been commonly followed ever since. In the Candollean system the primary division is into Vascular (more properly Phænogamous) plants, and Cellular (more properly Cryptogamous) plants.

These in turn are again divided, the former into Dicotyledenous or Exogenous and Monocotyledenous or Endogenous plants; the latter into Ætheogamous plants, those with sexual apparatus and vascular or cellular tissue, including Equisetaceæ, Filices, Musci and Hepaticæ, and Amphigamous plants, those destitute of sexual organs and composed of other than cellular tissue, including Lichens, Fungi, and Algæ. The great fault in this system was the non-recognition that plants of all orders are bisexual.

John Lindley, Robert Brown, and Stephen Endlicher, between 1827 and 1843, variously modified, and in some respects improved, the Candollean arrangement, and the "Genera Plantarum" of George Bentham and Joseph D. Hooker, the third and concluding volume of which was issued seven years ago, brings our history ot botany down to the present day. These latter authors adopt in a general way the Candollean sequence of orders, with various emendations, and theirs is the system now generally followed. Begun in 1862 and finished in 1883, these volumes stand as the second great botanical work of the present century, the "Prodromus" of De Candolle being the first.

In the September, 1883, number of the "American Journal of Science," Dr. Gray compared the various published "Genera Plantarum" in the following way, which may be of interest to you: "Some idea of the progressive enlargement of the field may be had by a comparison of the number of genera characterized in these successive works. The phænogamous genera of

Linnæus,	"Genera	Plantarum,"	published	1737,	were	887
Jussieu,	"	"	"	1789,	"	1707
Eudltcher,	"	"	"	1843,	"	6400
Bentham & Hooker,	"	"	"	1883,	"	7585

An estimate of the known number ot species of each genus and higher group has been made throughout the work. In round numbers it may tairly be said that about one hundred thousand species of phenogamous plants are in the hands of botanists."

It will thus be seen that in a little less than one hundred and fifty years the number of genera has been increased from 887 to 7585.

I cannot close this brief, though I fear for your patience too lengthy, account of the history of botany, without calling to your attention the names of some of the most distinguished writers on

American plants, whose efforts have in more ways than one helped to bring the noble science of botany to its present advanced state. Among them are Bartram, Michaux, Muhlenberg, Pursh, Eaton, Nuttall, Torrey, Bigelow, and, last but greatest, the late, lamented Dr. Asa Gray, at whose death, so recently as January, 1888, our society expressed by unanimous resolution its deep regret.

"COINAGE AND MONEY."

BY H. B. SMALL, OTTAWA.

Read before the Hamilton Association, 10th April, 1890.

It has been said that if money has made men worse than they were before it, it has also introduced conveniences which previous generations did not possess.

When in the days of old there was no such thing as any currency of money, all transactions were carried on by barter—exchanging one thing for another, and it was to obviate the inconvenience of this, and to obtain a uniformity of value that coin was brought into use; first, in the unwieldy state of bullion, when payments were made by weight, and clipping off so much as was necessary, afterwards by pieces of metal rudely stamped with their weight, and finally in the medallion form, existing to the present day.

At one period of history cattle seem to have been the sole form of money in use, and from the Latin word *pecus*, which means cattle, the word pecunia (money) was derived, and so familiar nowadays in the expression pecuniary embarrassments, or pecuniary transactions. It is not so very long ago on this continent, that skins were used to represent a money standard, especially at the old Hudson Bay posts; whilst dried fish have stood in lieu of cash amongst the Newfoundlanders, and in the more primitive parts of Nova Scotia. The word money is derived from the fact of the early Roman coins being struck in the temple of Juno Moneta, that latter appellation coming from the word "monere" to warn, because that temple was built on the spot where Manlius heard the Gauls approaching to attack the city. Coin is derived from the word cuneo, to force in. All civilized nations have gold as the standard of money, and all other circulating media are but the representatives of that standard.

In Africa where the human race is very low in the scale, a small shell—a specie of cowrie—forms the circulating medium; in Abyssinia, salt, bricks and beads are used, whilst the ancient Britons employed iron and bronze rings for that purpose. The Greeks of

Phocoea in Ionia, in the 7th century before Christ, were the first to conceive the idea of stamping a design on coins, using their city arms, a phoca, or seal, to give the warranty of the state for the right weight and value of their money. Thence the art of coining spread rapidly to the other Greek towns of Asia Minor, and was transplanted to Ægina, Athens, and the Greek colonies in Africa and Italy. The weight of the most ancient gold coin, according to Max Muller, in all these countries, was originally the same as that of the old Babylonian gold shekel, or pound, only stamped with the arms of each country. This shekel, in spite of historical disturbances, has held its own through centuries. The gold coins of Croesus, Darius, Philip and Alexander, have all the same weight as the old Babylonian shekel, 60 of them going to one mina, and what is stranger still, our own sovereign, or pound, has nearly the same weight, and whilst 20 silver drachms or half shekels went to a gold shekel, 20 silver shillings are equal to one sovereign. On this basis was the ratio fixed between gold and silver.

The origin of the pound sterling is as follows :—In the days of William the Conqueror, the management of the currency was in the hands of the Jews, who thoroughly understood the principles of money. They took a certain quantity of silver, or a weight known as the "Tower" pound, something between a Roman pound and a pound Troy. This was the standard of measurement, the unit of value. Out of this pound were cut twenty separate pieces, from each of which were then cut twelve separate coins or pennies, whose weight was a pennyweight—the 240th part of a lb. Troy, and this became the actual coin in circulation, for shillings were not then coined for use. These silver pennies weighed each one-twentieth part of an ounce, and in modern money were worth about 2½d. This system lasted till the reign of Edward I., or about the year 1300, when the Jews were banished, and their places as money merchants were taken by Italians who had been brought in to manage the coining operations of the mint. They introduced gold for coinage, and then the pound sterling ceased to be a pound weight of sterling silver, for the Tower pound was divided into thirty or forty parts, still called shillings, of which 20 made up a pound sterling, and the metal was debased by alloys so as to increase the circulating medium at the expense of the people. There was no standard for this new gold coinage, and this value had to be estimated in silver,

and it was not till 1717 that this value was fixed by law. Gold, in time, took its valuation from the quantity of silver it would purchase, and in due course of time the position was reversed, and gold became the standard by which everything was measured. The pound sterling of to-day is composed of 22 parts of pure gold to two of alloy, and the gold constituting it is fixed by law at £3 17s. 10½d. per oz. of gold bullion. The pound sterling now, although represented by a gold coin, is a mere figure of speech, representing what was originally an actual tangible thing. The first record of gold coin struck in England after the Roman sway, and that of the early British, occurs in 1257.

Thousands of ancient coins have been tested, and the result has been to show that a ratio between gold and silver was fixed from the earliest times with the most exact accuracy, and Dr. Bruysch shows that for international trade and tribute, the old Babylonian standard was maintained for a very long time, and the great political and commercial nations of the old world solved thereby the bi-metallic problem, and maintained for centuries a fixed standard between gold and silver. This standard, though influenced no doubt by the relative quantity of the two metals, by the cost of production, and by the demand for either gold or silver in the markets of that day, was kept up as a safeguard for the interests of the traders of that time. Modern financiers tell us that a change in the ratio between gold and silver cannot be entirely prevented, but it took place by very small degrees in early days. From the 16th century before Christ, or if we take only coined money, from the 7th century, B. C., to nearly to-day, the appreciation of gold has been no more than 1⅔, viz: from 13⅓ to 15, and any further disturbance, such as not long ago threatened, or partly took place, may be due to the resolution of certain governments to boycott for their own purposes the second most precious metal in the world. The term appreciation of gold is the purchasing power of money, taking it as the measure value of commodities, and itself measured by them. The depreciation of prices, and the appreciation of gold as the standard of value, thus mean the same thing. But I am digressing, and this point of bi-metallism belongs to the sphere of political economy more than to our subject.

Gold, however, at last, came in a certain sense to be laid aside by the introdution of paper money, necessitated by the extension of

commerce, which required that money should be expressed in a small portable form. Hence, Bills of Exchange, Promissory Notes, Drafts, and other commercial paper media. Paper money, however, did not fill all that was wanted, and the worthy company of goldsmiths of London, as early as 1600, issued notes to pay for monies loaned them on security—the first banking institution in England, on record. In 1604, the Bank of England was projected, and went into operation, issuing its notes—and then came consols, stocks, and shares representing the National Debt of England, somewhere now about £800,000,000.

The numismatic researches which have been carried on with indefatigable industry by some of the most eminent scholars, may seem simply curious, but like all other historical studies, convey many useful lessons. Coins and medallions perpetuate the memory of great nations, and faithful to its change of fame the medal has transmitted events, the history of which must otherwise have long since perished. They comprise a compendious chart of history, chronology, and heathen mythology, a system of classic architecture, and they constitute an accurate commentary upon the more celebrated poems of Greece and Rome. It is not the metal, but the erudition that stamps the value of a coin in a cabinet.

The names of various coins are traceable with a little research, and show how ordinary adaptations have brought them into common use, without, very often, a thought being given to their origin. Some are from their weight, as the word "Pound"—the French "Livre"—Italian "Lira,"—others from the metal as "Rupee" from the Sanscrit word "Rupya"—silver; others from their design, as the "Angel"—the "Testoon" from teste, or "tete" a head; others from the State, as a "Sovereign," "Crown"; others from the proper name of the monarch, as the "Daric" from "Darius"—the "Louis d'or"—the "Napoleon." The Dollar, or Thaler is from the "Joachims Thaler," or money of the Joachims valley, where these coins were first struck in the 16th century. Guineas took their name from the country where the gold composing them was obtained, and the first guineas bore the impression of an elephant in token of their African origin. The "Franc" is an abbreviation of Franconum Rex. The "Sou" is from the Latin "Solidus." "Shilling" is derived from a word signifying "to divide" and the name is sometimes taken to signify the fraction of a larger coin, as "half-penny," "farthing," "cent" and "mill." The word

"Pound," as said before, originally was not a coin, but a pound of silver, or 240 pennies. The origin of penny is not known, but is said to be from "pender" to weigh. The word "sterling' as applied to money, was used in connection with the Easterlings or North German merchants, whose transactions were mostly of a monetary nature. In the reign of Henry I. of England, the legal tender money was frabicated out of wood. This instrument was called an exchange tally, and, by virtue of it, the holder was entitled to receive from the crown, the value inscribed thereon. It consisted of one-half of a four-sided rod on which was carved in tranverse notches, the sum it purported to represent. These signs were for the unlearned, whilst for the educated, the sum was written on two opposite sides of the rod, which being then split, one-half, called the tally or check, was given to the party for whose use it was intended; the other half, called the counter tally, was laid up in safe keeping till its corresponding tally should be brought in by the person who had last given value for it It was a current token of real money, and served to distribute it from man to man by this exchange. From this was derived the Exchequer Bill in 1696. The word "bill" was derived from the Norman word bille, a rod or staff. Soldiers are to day said to be billeted because formerly they tendered wooden billes, or tallies to those on whom they were quartered. Officers of the army, taken into the King,s own pay, were said to be "put on the staff," because they were paid with wooden tallies or billets.

Of gold coinage, that of England and the United States is probably as graceful and attractive as any that now exists, and the twenty franc pieces of Italy are also very handsome. Half, and quarter dollar gold pieces struck in California are the smallest gold coins known, but they were never in circulation. The most beautiful silver coinage is that of Russia, each piece being in itself a work of art, so finely and elaborately is the die cast. The ugliest silver coinage is that of Hamburg, the metal adulterated and poorly executed, and from its dirty looking condition it resembles a piece of refuse tin more than any other metal. The neatest paper money is that of Greece, and the old bank currency of America in its day was well executed. The worst is the Austrian 5 kreutzrer note, printed on a soft thick greyish paper, which has the faculty of rubbing away like ordinary blotting paper.

To enumerate the coins of antiquity, which grace various cabi-

nets, is not the object of this paper. Not unfrequently, when the real coins of a certain date are unobtainable by the collector, imitations of them are used, and these go by the name of Paduans and Beckers. Becker was an artist of Frankfort, who excelled in imitating coins, but never used his skill for the purpose of deception, honestly selling his productions as avowed copies, which are admitted into cabinets under the name of Beckers. Paduans derive their name from two brothers at Padua, celebrated for the same work as Becker. The shilling of Henry VII. is remarkable as being the first silver coin of that value ever struck. A silver groat of Perkin Warbeck, dated 1494, is a great rarity, having been struck by the order of the Duchess of Burgundy for Perkin Warbeck when he set out to invade England. The erroneous idea of a Queen Anne's farthing being scarce and of great value, arose through the advertisement of an old lady who had lost one, which stated that it was one of the only three known, and worth at least £100. There are several types of these farthings, but the only one intended for currency bears date 1714, the others being merely struck as patterns, and they are not un common. The farthing and the sixpence of Oliver Cromwell are much more scarce, for after he had stamped his head upon them he was afraid to issue them as currency. The crown piece of Cromwell is very scarce, and there is a tradition that the die became cracked across the neck after a few impressions were struck, which having been considered ominous, the issue was stopped and the coin recalled.

The large penny pieces of William IV. are scarce, owing to a rumor current, which caused the Jews to buy them up, that a crucible of gold had accidently been mixed with the copper composing those pieces during coinage, and that by remelting them this gold could be extracted. Whether such was the case or not history will never record, as the mysteries of the mint are kept sacred, and its records are never made public.

Until the reign of Charles II., the coinage had been struck by a process as old as the 13th century, when Edward I. invited skilled artists from Florence to improve the rude money then current, and the methods adopted by them were maintained. By these artists, or designers, the metal was divided by shears, and then stamped and shaped by the hammer, everything being left to the eye and the hand of the workman. Some pieces consequently were larger or smaller, few were exactly round, and the rims were not

milled. Clipping coin thus became an easy and profitable fraud. In Elizabeth's time this was high treason, and subjected clippers to the penalties for that offence. In consequence of this mutilation, a great improvement was suggested in Charles IInd's reign, and a mill which to a great extent superseded handwork, was set up in the Tower of London, and was worked by horse-power. Pieces turned out by it were not easily counterfeited. They were perfectly circular, and their edges were inscribed with a legend. But the hammered coins were not withdrawn, as the financiers of that day expected the new coinage would soon displace the old. But the reverse was the result, for when it was found out that a clipped coin went as far in the payment of debts as a milled edged one, the latter found their way into the crucible, or abroad. The wiseacres of the government of that day marvelled that people should be so perverse as to use light money in preference to that of full weight, and as each lot of new coinage appeared it as quickly disappeared. A writer of that day mentions the case of a merchant, who in a sum of £35 received only one-half crown in milled or new coinage. In 1695, five millions in nominal value of the coinages of Elizabeth, James I. and Charles I., were in circulation, with half a million of the new issue, and two-thirds of the whole was clipped. Coiners multiplied, and the extreme penalty of the law was continually enforced, the punishment then being death. At this juncture, when trade was all but paralyzed, Parliament took up the coinage question, and the debate lasted for several days. The result was as follows: The money of the kingdom was to be recoined according to the old standard of weight and finance; all new pieces were to be milled; the loss in the clipped pieces was to be borne by the public; that a time should be fixed after which no clipped money should pass except in payments to the government, and a later time was fixed after which no clipped money was to be passed at all. The loss was to be met by the imposition of a tax upon windows, which continued to be levied long after the immediate occasion had passed away. Until milled silver come into circulation a guinea passed for thirty shillings. When the former became plentiful, it fell to 21, 6, and finally to 21 shillings, which it ever after retained.

Pepys, in his diary in 1664, says: "The old law of prohibiting bullion to be exported, was a folly and injury, rather than good, for if the exportations exceeded the importations, then the value

must be brought home in money, which, when our merchants know cannot be carried out again, they will forbear to bring home in money, but let it lie abroad for trade, or keep in foreign banks; or if our importations exceed our exportations, then to keep credit the merchants will and must find ways of carrying out money by stealth, which is a most easy thing to do, and is everywhere done, and therefore the law against it signifies nothing. Besides it is seen where money is free there is plenty, where it is restrained, as here (England), there is great want."

It is a curious fact that paper should be the only article used to represent commerce, when leather or cloth would seem to be so much more durable. Yet bank note paper lasts a long time, and not unfrequently the Bank of England receives a note of extraordinary age. The Bank of Bengal, in India, was once called upon to pay several thousand pounds of notes so old that none of the present generation remembered the pattern. A traveller in France, not many years ago, found a 1,000 franc note pasted on the inside wall of peasant's hut as a pretty picture, which the man said he had picked up years before, and so firmly was it pasted on, that the brick to which the note adhered had to be taken to the bank where it was at once cashed, and is still retained as a curiosity. Leather, according to Socrates, was used in Carthage for coinage at one period, and in 1360, King John of France, having to pay Edward III., of England, 300,000 golden crowns for his ransom, was so impoverished as to be compelled to resort to a coinage of leather for the discharge of his household expenses. Seneca tells us that under Numa Pompilius, both wood and leather took the place of coin, being stamped of a certain value, a fact also put in practice by Frederick II. at the siege of Milan.

The Bank of England never issues a note a second time. When once it finds its way back to the bank to be exchanged for coin, it is immediately cancelled. The average life of a Bank of England note, or the time in which it is in circulation, is not more than five or six days. The returned notes average about 50,000 a day, and represent, one day with another, about one million pounds in value. Sorted and cancelled, these notes are packed away for five years, at the end of which they are consumed in a furnace, but so perfect is the system under which they are registered and stored, that any particular one, provided the number is asked for, can be

produced in a very few minutes. The Bank and its offices, including the printing rooms, for all its notes are printed on its own premises, cover nearly three acres, and it employs in town and country nearly 900 officials.

Over £11,000 worth of silver is wasted every year in the course of the circulation of the English silver coinage. Mr. Miller, a well-known authority on money, weighed, in 1859, one hundred sovereigns coined in 1820, and found a loss in weight by circulation of £1, 6s. 7d. In the numberless handlings a shilling has to submit to in the course of years, the loss arising therefrom becomes at last sensible to the ordinary balance. Coins suffer also from abrading each other when jingling in the pocket, and they are damaged each time they are rung on a counter. Every minute particle of matter removed in any way lessens the weight and makes coins look old, and in the lesser pieces which are much used, this proceeds to a marked extent. Several processes have been traced in England for abstracting a certain portion of metal from coins without defacing them; one of these, which was attributed to Jews, being known as "sweating." This was done by shaking together in a leather bag for some time a number of sovereigns, and then collecting the particles which the coins had lost. Another process was placing coin in contact with sulphur or in its fumes, which covered the pieces heavily with a coating which was subsequently removed by a chemical process, or by polishing, and which thus abstracted a certain value without defacing the coins themselves. Plugging with base metal and gilding or silvering the plug was another trick, and so largely was the process of boring a hole in silver pieces carried on that such bored pieces were finally refused; and in the United States no defaced coin will be taken in trade at any value whatever.

A paper was read in November last (1889) before the Institute of Bankers, in London, by Mr. R. H. Inglis-Palgrave, F. R. S., on the note circulation of England and Wales, urging the re establishment of paper money of the value of one pound. He alluded to the new issue of postal orders for small sums, which, supplemented by stamps when making up odd shillings and pence is required, as shewing the demand for such currency; and quite a discussion followed on this subject. He said: "New South Wales, Victoria, South and West Australia, Queensland, Tasmania, and New Zealand

are flooded with paper currency from one pound upwards. As a rule, indeed, the colonists prefer paper to gold; still the notes of one colony can only be cashed in another by the payment of a considerable discount; and if ever the dream of Australasian federation becomes a reality, the unity of currency will be as vital an element in the federal constitution as the unity of custom houses, postoffices and colonial defences." In the United States, again, gorged as are the national coffers and the bankers' strong rooms with gold and silver, paper is generally preferred to bullion. The latter is often contumaciously alluded to as "truck," and apologies are made when it is tendered in payment. It may be that there is something akin to vanity, or at all events to pardonable complacency, in this partiality to paper money. The American does not fail to remember that the old war greenbacks have been triumphantly redeemed, and that those securities, together with the almost innumerable local notes — many of them of a more or less "wild cat" order — have all been superseded by a national bank note, locally issued, but fully secured by funds deposited in the National Treasury at Washington. It is only in the Golden State of California that the feeling in favor of solid cash, as against paper promises to pay, has not entirely disappeared, and San Francisco is almost the only city in the Union where a lawyer does not object to receive his fees, or a merchant his account in a rouleau of twenty dollar gold pieces, splendid to look upon but somewhat cumbrous to carry. An analogous fondness for the doubloon, or "onza de oro," is to be found in Cuba, in Mexico, and in some states of South America. Returning to Europe, we find that in Italy, although the "corso forzato" has become a thing of the past and paper money is redeemable for cash at par, business is almost entirely carried on by means of large or small notes. Germany has got a new coinage and is getting rid of small notes; but Austria is yet subject to the boon or the bane of illimitable shin-plasters. In Spain it is very difficult to obtain gold for notes, and the whole Peninsula swarms with spurious silver "duros" and "pesetas;" while as regards Russia there is no exaggeration in saying that many millions of the people have never seen a nationally coined piece of gold or silver. Bank notes, generally ragged and horribly dirty, are the popular currency, and have been so ever since the time of the Crimean war; and of how many millions of the rouble and half-rouble notes in circulation

are forged, probably neither the minister of finance nor the national bank, nor the police, have the remotest idea.

Our French neighbors, like the Belgians, will tolerate a twenty franc note, but there in the descendent scale they inflexibly draw the line. Just after the Franco-German war of 1870-1, there was, for a short time, a terrible scarcity of hard cash. What ready money there was had been hidden or buried by the frightened possessors thereof. The Bank of France, in stress of gold and silver, was fain reluctantly and tentatively to issue five franc notes. After a very little while the public would have none of them. They feared a yet further descent in denomination. They dreaded franc, half-franc, twenty-five centimes notes. They shuddered at the gory spectre which seemed to be hovering over them—the phantom of the assignats; the awful "shin-plasters" of the Revolution, which were never redeemed, and the depreciation of which was aggravated by the cynical policy of Mr. Pitt, who, in order to hasten the bankruptcy of the Republic, caused assignats by the hundred weight, forged in England, to be smuggled into France. The Roman Emperor said that money had no odour. As a matter of fact, in sadly numerous instances it has had the smell of blood. The French assignat reeks with sanguinary memories; and little less ghastly is the history of the English one pound note.

There is extant a rare pamphlet, published in 1819, being a report of a Committee of the Society of Arts, relative to the mode of preventing the forgery of bank notes, and the publication of this curious document is justified by the remark that since 1815 the convictions before the Criminal Courts for bank note forgery had increased in an alarming ratio, while juries became more and more reluctant to visit with the extreme penalty of the law, a crime for the prevention of which no successful precautions had been taken. Added to this was the notorious fact that at many recent trials it had been shown that forged notes had passed, undetected, under the scrutiny of the Bank inspectors. Appended to the report are several models of one pound notes proposed to be issued, and so artistically and elaborately engraved, as, in the opinion of the Committee, to defy the skill of the most expert forger. Among these perhaps the most singular is a one pound note produced exclusively by means of typography and wood engraving, which it was claimed could never be imitated, inasmuch as to execute it there would be required the

co-operation of punch-cutters, matrix-makers, mould-makers, casters, breakers, rubbers, setters-up, compositors, readers, press-men, engravers, and engine turners, and it was beyond the reach of probability that such a confederation of skilled malefactors could be brought together for the consummation of a single fraud. The framers of the report, however, little dreamt of what was to be done in the future by photography and photogravure. The sheet-anchor of every bank note is now in the paper. Should we be quite sure of our anchorage in an ocean of new one pound notes?

It is only of late years that the fact has been ascertained that banking was carried on in very early ages. Mr. Hilton, F. G. S. of the Institute of Bankers, says that as far back as 2250 B. C., the Chinese and Hindoos carried on operations equivalent to it; and Mr. George Smith of the British Musuem, the great Assyrian authority, discovered tablets amongst the Assyrian marbles whose translation showed cheques, receipts and other records of a great firm of the name of Egibi, which flourished 507 B. C. A remarkable fact in connection with these was that each bore the day of the month, date and year of the monarch in whose reign the transactions were made. Among the tablets was also a bank almanac of the firm, containing the complete calendar of the Babylonian year. A form of cheque called the attribute or prescriptum was known amongst the Romans, but it is not recorded whether it was payable only to bearer or to anyone else. Recent discoveries in Pompeii have unearthed tablets used by a Roman banker, showing receipts for payments, and the registration of payments made to the public exchequer. No details, however, have been discovered, of any transactions beyond daily use, and no records have yet come to light, of promises to pay, or acceptances.

Up to the year 1707, Scotch coins were quite distinct from English, consisting of pistoles, marks, nobles, besides base money of Atkinson's or Achison's (8d.) bawbees, placks, and boddles. The Irish coins have always been made in England and sent thence to Ireland, there being no mint in that country, but their value was not as high, the shilling being only worth 11d, and their pound 18 shillings and four pence halfpenny. In like manner, in the Channel islands, the shilling is worth thirteen pence, and the pound 21s. Many of us remember the Halifax currency here, before the decimal currency was adopted, when 16s. sterling was called a pound.

The reason why coins are always struck, and not cast in a mould is from the fact that gold, silver and copper, sustain a contraction in their transition from the liquid to the solid state, and cannot therefore be cast to the figure of a mould, consequently their impression must be stamped.

The coinage of a country is ever on the change, a new coin being produced while another is called in. In England the following coins have disappeared—the silver groat and half groat, 4d. and 2d, introduced by Edward III., the testoon by Henry VII; Elizabeth's three half-penny and three farthing pieces; the mark, noble, royal, spur-royal, angel and angelet, and the tin-half pence and farthing coined by Charles II. Less than a century ago, five guinea and two guinea gold pieces, and twopenny pieces in copper, were in general circulation; guineas succumbed to the necessities of political ecomomy, whilst crowns and fourpenny "bits" have died out within quite a recent period. The florin is a comparatively new coin, but is not often seen in this country, whilst the seven-shilling gold piece is only found in the collections of the numismatist, or forming an ornament to a watch chain, along with the old spade guinea. Even the large copper penny of our father's time is supplanted by a smaller coin of bronze, and to give a more familiar illustration at our own door, it is quite within the memory of us all when our Banks had to recall all their paper issue under five dollars, and these notes were supplanted by a government issue of Dominion Notes of one, two and four dollars value respectively. The "Sous" of Lower Canada and the Bank token of Upper Canada are becoming scarce, with the larger coinage and circulation of the cent, and Canadian silver currency has now driven from trade the various silver coins which formerly were current all through our land.

The earliest coinage that can be called American was ordered by the Virginia Company, and was minted in the Bermudas in 1612, when, and for many years after, the standard currency of Virginia was tobacco. In 1645 the Virginia Assembly provided for the issue of copper coins of the denominations of 2d., 3d., 6d. and 9d. Seven years later, in 1652, the general court of Massachusetts passed an order creating a "Mint-House" at Boston, and which directed "the "coinage of 12d., 6d. and 3d. pieces, which shall be for form flat, "and stamped on one side with N. E., and on the other side with "12, 6, 3, according to the value of each piece, in Roman numerals."

This mint also produced the oak-tree and pine-tree shillings. During the reign of William and Mary, copper coins were struck in England for Carolina and New England; and for Maryland Lord Baltimore caused silver shillings, sixpences and fourpences, to be coined in London. In 1785, Connecticut and Vermont established their own mints for copper coinage, and New Jersey followed in 1786. The Act which established the United States Mint was passed in 1791, and the building was commenced in Philadelphia the following year. The first purchase of metal for coinage there consisted of 6 lbs. of old copper, and the first cents struck for circulation bear date 1793. The original mint was moved in 1831 to its present quarters on Chestnut street, and till 1835 was the only mint in the United States. In that year branches were established at New Orleans, at Charlotte in North Carolina, at Dahlonega, Georgia, and in 1854 another branch was opened in San Francisco, the coinage of each of which is denoted by an initial letter upon the face of the coin. Philadelphia, as the parent mint, uses no initial.

In 1794 the regular coinage of dollars began, and the coins of that year sell now for $100 each. It was an adaptation of the Spanish milled dollar or "piastre," a coin very popular wherever the Spaniards went The Spaniards took the German name "thaler," which was acknowledged under Charles V. as the coin of the world, and pronounced by the North Germans as "dahler." It was corrupted eventually into dollar, Charles V. being entitled "Emperor of Germany. King of Spain, and Lord of Spanish America."

The Numismatic Society of Montreal has done much to shed light on the history of Canadian coins, and a catalogue published under their auspices by Mr. Sandham, is a standard authority on the subject. Dr. Leroux has also contributed to this research by means of an illustrated work, and Mr. R. W. McLachlan has brought out the most complete compilation in his recent volume. I must here quote from it a passage of interest in connection with the early French settlements. Speaking of the French American, and especially of that of 1755, which bore an impression of the golden fleece, he says: "Many were the Jasons in those adventurous days who set out for New France, expecting to return with the much coveted auriferous prize. But the *fleecing* of the poor habitants indulged in by some of the governors and intendants were the nearest approach to the *Golden Fleece* which they ever obtained. To this cause more

than to all others may we attribute the failure of French anticipations in the building up of a glorious empire in America."

It is perfectly astonishing to others than coin collectors, what enormous prices are sometimes paid for a rare coin, and the value is occasionally run up at sales when two or three wealthy collectors are vieing with each other for some unique specimen or piece which they eagerly desire to possess. The greatest sale on record, by public auction, was the collection of Lord Northwick in 1859 and 1860. The former consisted of Greek coins only, and realized £8,568; the latter, of Roman and later pieces, realized £3,320. A Greek coin of Camarina was bought there by the British Museum for £52, and a coin of Agrigentum brought £159. One Syrian coin, viz: "Cleopatra," Queen of Syria, was bought by the British Museum for £240. Lord Northwick, who lived to a great age, had spent his life collecting, and from 1790 to 1800 he spent these ten years in Italy collecting antiquities, with the assistance of Sir Wm. Hamilton, then ambassador at Naples. Since his sale there has been nothing to approach it.

Were it not for continually new discoveries in Europe of hidden treasure, the resources for collecting would soon pass into the hands of the few. But excavations and building operations frequently bring to light new finds, and very often in the most unexpected places. From the beds of rivers, around old foundations, on the site of Roman camps, and in the East Indies especially, where hoarding is to this day largely the practice, coins are constantly procured, and, as in olden times treasure was hidden at the approach of an enemy, or when its owner was anxious for its safety, pestilence, sudden death, or the carrying off into bondage of the owner without his return, caused the hiding place to remain unknown for centuries, and a vast amount of ancient wealth doubtless lies buried away for discovery in future ages.

And now I want to say something about the wealth of the ancients, those who lived in what was really the "golden age." We use the term to-day, "money king," but the wealth of our millionaires fairly pales before some of the recorded amounts of the old Greeks and Romans. History tells us that Ptolemy Philadelphus of Egypt, 283 B. C., amassed a sum equal to $1,000,000,000 of our money. Cicero, like all literary men, was impecunious, yet he gave $150,000 for a villa; Clodius, his bitter enemy, paid $550,000 for

his town residence on the Palatine, and Massala, who also wished to live in the same quarter, that being the fashionable part of Rome, bought Marc Anthony's old residence for $2,000,000. Seneca, the philosopher, lived on the income of $20,000,000, which Sullius charged him to have amassed by usury. Tiberius left $1,300,000 to be divided amongst his heirs. Cæsar, before going into politics, owned some $14,000,000, and we can understand why the objection was raised when he was appointed Governor of Spain. Marc Anthony, we are told, when quite young owned $2,000,000, through the extravagant life he led with Curio, and later in life, he at one time settled a debt of $1,500,000, by paying cash in fifteen days. Subsequently he managed to spend $800,000,000 of the public money in an incredibly short space of time, as recorded by Plutarch. A supper of Caligulus cost $400,000; his favorite horse was kept in an ivory stall, and fed from a golden manger, with gilded corn. Esopus, an actor of note, (not the fabulist), paid $100,000 for one dish. Heliogabalus used bedsteads of solid silver, his plates were of pure gold—his mattrasses covered with carpet or cloth of gold, and were stuffed with down from the under wings of the partridge. One Roman Emperor had a dish compounded of nightingales' tongues, and another of peacocks' brains, and the extravagance and lavishness that resulted in the ultimate downfall of the nation was satirized by Juvenal equally as well as by any critic of to-day. Varro speaks of one Ptolemy, a private gentleman, who kept 8000 horses, had generally 500 guests at his table with a gold cup set before each, and which was changed with each course. Pythius, of Bithynia, feasted the whole army of Xerxes in one day at his own cost—1,700,000 strong. The public buildings of Rome, moreover, shewed the wealth of that day. Scarus built a theatre to hold 30,000 spectators, and adorned with 3,000 brazen statues. In the Circus Maxinus, built by Tarquinius Priscus, 395,000 persons could be accommodated, and it was always full when sports were going on. Nine thousand public baths were maintained in Rome at one time. The Temples—the churches of that day—were treasuries of wealth. The Palace of Nero was overlaid with gold and embellished with gems and mother-of-pearl. Its ceilings were fretted with ivory coffers made to turn, that flowers might be showered down on the guests, and furnished with pipes for sprays of perfume. Time fails to add to this list, but Thebes, Alexandria, Athens, Ephesus and Carthage,

possessed buildings far surpassing any of modern times. In those days extremes met, the poor *were* poor, and the rich *very* rich. How their wealth was accumulated history is silent, but corruption was rampant amongst the upper classes of that day.

Mr. Griffen, the famous statistician, recently stated, when speaking of the accumulated wealth of Great Britain, that if the several countries were to be separated, England would be entitled to £308 a head, Scotland £243, Ireland £93. Making a comparison of the three richest nations of the world he said that the wealth per head of the population is as follows; Great Britain £270, or $1.276; France £190, or $912; United States £160, or $768.

Earl Russell, in an address made by him before the University of Aberdeen, alluding to the corruption which prefaced the fall of Rome, said such a state of things was not confined to Rome. We, he said, have not yet got quite so low, but we have arrived at a point where intellectual greatness ceases to be appreciated, and a low sensualism characterizes our habits. It is for this that money is needed, and the more that is acquired and spent the more is needed. It is through the eager desire for the acquisition of riches in the briefest space of time that our stupendous failures occur, our defalcations, and our records of destitution and pauperism so discreditable to national honor follow in their wake. In the pursuit of wealth commercial morality disappears, and he cited the anecdote of a Quaker whose ship was so long at sea that he went to effect an insurance upon it. The Company was equally wary. Pending the negotiation the merchant heard that his ship was lost. He wrote to the Secretary to this effect: "If thee hast not made out the policy, thee needest not, for I have heard from the ship." The Secretary filled up the policy at once, and handed it to the messenger, thinking what a stroke of business he had effected. The messenger returned with the reply—"Since thee hast made out the policy, it is all right, I have heard from the ship as I told thee—but—she is lost."

The late Henry Ward Beecher, in a lecture he delivered in Ottawa some years ago on the ministry of wealth, pointed out the different ideas of wealth as entertained by people in different stations of life, and delineated the pain of the avaricious millionaire, whose only thought was how to make his interest increase. A wealthy man, he said, should encourage and patronize Art and Beauty. The power to concentrate wealth had an influence on the suffrages of

electors, on the legislature, the courts of justice. The gigantic railway companies, he prophesied would eventually rule the destinies of this continent. The monarchy of wealth is an oppressive monarchy, and is becoming more so. Properly applied it would be the salvation of the nation, if not, it must be its downfall.

HAMILTON ASSOCIATION.

REPORT OF THE COUNCIL

Read at the Annual Meeting, held 8th May, 1890, for Session 1889-90.

The session now closed has been on the whole a successful one. The attendance has been satisfactory, and the papers read have been of a very superior character, while the interest manifested has been at least equal to that of former years.

Seven general meetings, and one special meeting have been held during the session, at which the following papers have been read, viz.:

1. The opening address of the President, Mr. B. E. Charlton, who set forth therein, in a very popular and practical manner, the pleasure and profit of scientific study to the business man and others. As the marvels revealed by science far exceeded the wildest flights of fancy portrayed by the novelist, its use as a means of recreation to all was urged.

2. "The Question of the Variation of Species" was treated by Mr. J. Alston Moffat, member of the Council of the Ontario Entomological Society.

3. "Indian Fable Literature," by Mr. H. B. Witton, Sr.

4. "Colors, Kromatics, and the Permanency of Pigments," by Mr. S. J. Ireland, Principal of the Hamilton Art School.

5. "Historical Botany," by T. J. W. Burgess, M. B., F. R. S. C.

6. "Coinage and Money," by Mr. H. B. Small, of Ottawa, an Honorary member of the Association.

7. "The River Valleys of the Niagara Escarpment," by Mr. D. F. H. Wilkins, B. A., of Beamsville.

The lease of our present premises having expired last May, the Council of the Association sought to obtain accomodation for the Natural History specimens, and room for holding our meetings in the new Public Free Library Building. For that purpose a deputation appointed by the Association had an interview with the Trustees of the Library, but failed to come to any arrangement. Since then the Hamilton Art School having secured the upper story of the Library building, the Directors of that institution have made us the offer of a five year's lease of 1200 feet of floor space for the annual rental of $130.00. This offer has been accepted, and it is hoped that the first meeting of our next session, commencing in November, will be held in our new premises.

During the year many contributions have been made to the Museum and Library. To all the friends who have added to the value of these branches of the Association work we tender our best thanks.

The Council having been asked to consider the question of giving or lending the books of the Association to the Free Library, has concluded to give and lend them, under conditions which are set forth, and may be found in the abstract of the Minutes of the Association meetings. This proposition having been confirmed by the Association, and accepted by the Trustees of the Library, the books have been handed over for the use of the public, though still the property of the Association.

The Sections, especially the Biological and Geological Sections, have been in active operation during the year, and the reports of these will be presented and published in the Transactions of the Session.

We cannot close this report without expressing our great esteem for Drs. Burgess and Reynolds, and also our regret for the loss of their valuable services to the Association by removal from the neighborhood. Dr. Burgess, during his connection with us, has done much to awaken fresh interest in scientific study, especially in Botany. The Association is indebted to him for the commencement that has been made to form a complete collection of the Flora of Hamilton. Dr. Reynolds was for long the valued Secretary of the Biological Section, and his services in that capacity will be much missed. We desire to express our best wishes for their success and happiness in their new sphere of labor.

Your Council hope that the entering upon the possession of our new and better premises will be the means of increasing our membership, and infusing new life into all the departments of our work.

All of which is respectfully submitted.

B E. CHARLTON, *President.* A. ALEXANDER, *Secretary.*

ANNUAL REPORT

OF THE

BIOLOGICAL SECTION

SESSION 1889-90.

During the past season some fifteen meetings have been held in this Museum, and two—in June and July—by the kindness of Mr. Alexander, at his residence, where his beautiful garden proved an attractive resort on a warm summer evening, and some time was agreeably occupied in inspecting the results of his experiment in botany.

Few regular papers have been read, the meetings generally being of an informal but none the less enjoyable character, and many interesting subjects were brought up, leading to general discussions, whereby a good deal of valuable information regarding natural history items was elucidated. Some of the earlier meetings were given up to the exhibition of specimens.

At the meeting on Nov. 1, Mr. J. Alston Moffat reported for the Entomological division, having added twelve new species of moths to his collection, by no means a poor showing considering the poverty of insect life during the summer, owing no doubt to the peculiar weather experienced, an early spring followed by continued rains and killing frosts as late as the beginning of June.

At the meeting on March 7th, in the absence of Dr. Burgess, Mr. Alexander presented the report of the Botanical division, showing an addition of two hundred and nineteen species to the Herbarium, donated by Dr. Burgess and Messrs. Alexander, Walker and Morris, of this number two hundred and four were species new to the collection, and no less than thirty-three new to the Hamilton Flora as recorded by Logie and Buchan. A number of interesting plants

collected on an island in the Georgian Bay were shown by Mr. Alexander at one of the meetings.

The Conchological report presented on April 18, by Mr. Hanham, showed a total of ninety species of land and fresh water shells taken in this district up to the close of 1889, an increase of fifty per cent. on the list presented for 1888. There still remains much to be done in this line, not so much in the addition of many new species, but in the thorough working of the district—much of which is yet untouched—to learn the distribution, habits, and locality of the different species A careful exploration of Hamilton Bay and Dundas Marsh would without doubt double the number of the Unionidæ observed here, at present numbering only thirteen named species.

The following are some of the papers read:

Oct. 19. "Notes on Bumble Bees," J. Alston Moffat.

Nov. 1. "Botanical Notes, (Man's agency in plant distribution)" Mr. Alexander.

Dec. 20. "Arctic forms of life," J. Alston Moffat.

Jan. 17. "Notes on formation of Coral Islands," B. E. Charlton.

March 17. "Notes on birds wintering in district," Thos. McIlwraith. (Illustrated by many beautiful specimens from his collection.)

April 18. "The elasticity of the constitution of plants," Mr. Alexander.

Besides these the section stands deeply indebted to Mr. Wm. Yates, of Hatchly, Ont., for many interesting notes on botany, ornithology, entomology, etc., contributed from time to time, and especially for his valuable "Notes on Snakes" being the papers read on February 7th and 21st.

Special mention must be made of a visit to this city of Mr. Wm. McIlwraith, of Rockhampton, Queensland, Australia. On Oct. 19th he favored this section with an address on the Flora and Fauna of Australia, dealing in a most eloquent and instructive manner with the differences in the aspect of Australia as compared with this country.

No organized field days were held this summer, an intended trip to Lake Medad on 24th of May falling through owing to the inability to secure suitable conveyances on that day. A week later however, Dr. Burgess and Mr. Hanham tramped it, and were well

repaid for their long walk, not only by the beautiful scenery on route and at the lake side, but by the number of rare plants and other objects of natural history secured. The Albion Mills, Ancaster, Dundas Marsh, Waterdown Ravine and other points were visited at intervals during the season.

In conclusion reference must be made to the great loss sustained not only by this section but by the Hamilton Association, by the departure of Drs. Reynolds and Burgess from this city. Dr. Reynolds was for the greater part of the session the secretary of this section, and well and ably did he fulfill all the duties pertaining thereto. Dr. Burgess as a botanist has few equals in this Dominion of Canada, and during his stay here was instrumental in infusing new life into all the branches of natural history. By these removals from the ranks of our by no means numerous workers, this section especially suffers, and the members of the Hamilton Association and all lovers of nature and nature's wonder-land are earnestly invited to come forward and assist in carrying on the good work that is being done by this section.

A. E. WALKER,
Chairman.

A. W. HANHAM,
Secretary.

ORNITHOLOGICAL DEPARTMENT

OF THE

BIOLOGICAL SECTION

BIRDS WINTERING NEAR HAMILTON.

BY MR. THOMAS M'ILWRAITH.

The migratory habits of birds is a subject which at all times presents many attractions to those who are fond of out door studies, and in our northern latitude it is especially interesting. In tropical countries the birds do not often change their habitat and are said to attract less notice on account of their perpetual presence. With us the extremes of temperature are so great that with few exceptions all our birds are migratory. Those which are with us during the summer and raise their young in this locality are known as summer residents, but a great number of species spend the season of reproduction still further north, paying us only a passing visit in spring and fall. We are accustomed to hear all these called American birds, but it would be more strictly correct to style them Canadian, for Canada is the land of their birth, and they visit the United States only to avoid the severity of winter. Having no particular tie to any locality at that season, many go as far south as the West India Islands, and to a few, South America forms the turning point. There is still another class more boreal in their habits, which spend most of their lives to the north of us, and only occasionally, in winter, come as far south as the latitude of Hamilton, and it is to this class I should like to direct your attention on the present occasion. These are termed winter visitors; they are not here every winter, and are sometimes seen only for a few days in a season, but the very uncertainty of their appearance and disappearance makes them objects of greater interest.

In October, when the sharp frosts have cut off the supply of insect food, and the swallows and other insect feeders have gone south, among the first arrivals from the north is the great *Northern Shrike*, Lanius executibitor, who, as his name implies, is a veritable butcher among the birds. Not satisfied with killing enough to supply present wants, he tears his victim to pieces and impales the parts, usually on the spikes of a thorn bush, but here we have an instance of the way in which birds will avail themselves of any accidental convenience which may come in their way, for in the prairies, where game is abundant, and thorn bushes absent, the victims are found ranged in rows on the barbs of the iron wire fences.

These Shrikes were common in October and November, but were not observed during December, January, nor February, having apparently gone further south, to return again in March and April.

Shore Larks, of the variety praticola, were seen in small flocks during the winter, but the numbers were greatly increased by arrivals from the south early in February; these latter may be regarded as the first spring migrants.

Cow Birds are considered migratory, though occasionally a few males are observed to winter about some of our farm houses, roosting in the sheds above the cattle. During the present season large flocks have been seen at different places in December, January and February. Of *Meadow Larks* the same may be said, for it is only now and then that we find an individual here in winter. During the present mild season I have noticed groups of four or five at several different points, in the months already named.

Song Sparrows were frequently seen among the rushes along the bay shore, which is not their usual habitat.

Snow Birds were seen at the beach in October, but this species seems to be always associated with snow, and that being scarce during the winter the birds were the same.

Red Polls put in an appearance quite early, and were common in weedy places during the season. There are five varieties described in this group, all of which no doubt visit us, though they receive so little attention that they may pass unnoticed. Last winter I was fortunate in securing a pair of a variety I had not before encountered. They were the "acanthis linaria rostrata," or Greater

Red Poll, stout hardy looking birds, measuring six inches in length, the common kind being only four and a half inches. They were observed feeding in company with the common species.

Early in October the first *Snowy Owls* were seen, and by the end of November their migration was over. I heard of seven having been obtained here, but at Toronto about forty were killed. These birds like to be near water, and large numbers come down the Ottawa valley, and thence westward along the north shore of Lake Ontario. The island at Toronto is a place just to their liking, dead fish and "cowheens" being abundant, but at that season of the year the marsh there is bristling with fowling pieces in the hands of those who are well practised in their use, and the owl skins being always in demand, scarcely an individnal is allowed to escape. Therefore, it is only those which have run the gauntlet at Toronto which we see here at all. It was remarked this season that a large number of those obtained were females.

At Toronto a *Razor-bill*, several *Great Grey Owls*, and one or two *Hawk Owls* were obtained. Near Hamilton, in the woods, the usual groups of *Downy* and *Hairy Woodpeckers*, *Chicadees*, *Brown Creepers*, *Kinglets* and *Nuthatches* have been observed, and *Blue Jays* have been often seen. *Crows* have been more numerous and active than usual, and flocks of *Goldfiinches* in winter dress have been seen in their usual haunts, but the most interesting visitors we have had for many years have been the *Evening Grossbeaks*. These birds are natives of British Columbia, and so little has been known of their history that it was not till 1887 that any account of their nest and eggs was published. In June of that year Mr. Walter E. Bryant read before the California Academy of Sciences an account of a nest of this species, which was found in Yolo county, California. The nest was placed in a small oak about ten feet from the ground, and was built of twigs rather loosely put together and lined with fibrous bark and horse hair. It contained four eggs of a clear greenish color, blotched with pale brown. The name, *Grosbeak*, is a corruption of the French *gros-bec*, meaning thick bill. There are several members of the same family peculiar to the United States, and to distinguish this from the others it was named the *Evening Grosbeak*, from a belief formerly entertained that it sung most frequently at that time of the day. The migratory course of the birds has heretofore been down the Pacific coast as far south as Arizona,

but within the past year or two they have come east to the Mississippi, many having spent last winter near Minneapolis, and St. Paul in Minnesota. During December, 1889, about the time the birds would be moving southward, we were visited by severe gales from the west and northwest. Either the birds were caught in these and carried eastward against their wishes, or finding a warm moist belt extending far east into a new country where food was plenty, they came on, led by some daring leader ambitious of exploring new territory, and visited us in numbers far in excess of anything previously known in the history of the species.

My first knowledge of their presence among us was from a friend who, on the 19th of December, brought me a pair which he had shot on the north shore of the bay near the powder house. I took an early opportunity to visit the locality, and found a flock of 20 or 30, males and females here being in about equal unmbers, feeding on the berries of the red cedar. They were by no means shy, but when disturbed went off east with a peculiar rattling call note. A few days afterwards I found a flock again at the same place, and was at a loss to know whether the same birds had returned, but this lot also went off east, and subsequently I learned that they had reached Toronto. It was now evident that those we daily noticed here were flocks passing from west to east, and this movement was kept up steadily till the 1st of February, when the eastern migration ceased. I learned from newspaper notices and correspondents that they had been seen at every town and village along the north shore of the lake, and a few got as far as Quebec. The bulk of the migration passed over into New York State, and were very generally distributed, delighting the eyes of many a lover of birds by their sprightly presence during the dull days of winter, when bird life is at its lowest ebb. Finding things to their liking in the east they were in no hurry to return, though small flocks were observed moving westward during March and April. As late as the beginning of May some were seen among the evergreens near this city, which led to the hope that they might remain and make their home with us permanently. We should be greatly pleased if such were the case, because, besides being pleasing objects to look upon they are fine songsters, and being very powerful birds, they might serve to keep in check the increase of the English sparrow, which seems at present determined to drive every other bird of similar size from the country.

There is another member of this family named the *Pine Grosbeak*, which has long been known as an occasional winter visitant. The young males and females of this species resemble each other in their plain attire of smokey grey, but the adult male, blushed all over with purplish crimson, is a most pleasing object when seen against a background of the sombre Norway spruce which they frequent. They were very common along the north shore of the lake from Kingston to Toronto. At Hamilton very few were seen, and those few did not remain. The reason of this was the absence of the mountain ash berries, which is their favorite fare. The mountain ash trees are numerous around Hamilton, and last fall the crop of berries was large; but near the city there is now a great deal of shrubbery, among which the robins nestle and raise their young. As soon as the berries are ripe the robins use them daily. If the frost sets in early these birds retire to the south, leaving many berries on the bushes, but if the fall is open they remain till the last berry is used up; therefore, when the *Pine Grosbeaks* arrived, there was nothing for them to eat, and they went elsewhere in search of food.

The last of this species was seen on the 21st of February, which is about their usual time for returning to the north.

Another northern visitor which seldom comes our way is the *Bohemian Waxwing*. I found three of this species in company with the *Grosbeaks*, and secured two, the third going quickly out of sight. I rested my gun against a small dead tree and went about picking off some twigs of the red cedar with their beautiful glaucous colored berries for parlor decoration, when, on turning round, there was the missing waxwing perched on top of the bush against which I had rested my gun, and there he sat and preened his plumage in perfect security. Twice I tried to reach my gun, but he raised his crest and turned his full dark eye on me so reproachfully that I had to satisfy myself with admiring his many graceful attitudes till it pleased him to go off, which he shortly did in safety, and was seen no more.

During February there was quite a gathering of Eagles around the shores of the bay, which at that time was only partly frozen over. They were the bald-headed species, one or two having the white head and tail shewing maturity. As many as twelve were said to have been in view at one time, and I knew of four having been shot and obtained. They used to frequent the dead trees along the banks of the Niagara River, and were a marked feature in the wild

scenery of the place, but their skins being in demand and the birds being readily picked off by the rifle, they are now but seldom seen in their former haunt. Gulls have also been numerous on the bay, so long as it was open, their favorite resting place being the edge of the ice where it meets the water. They are mostly *Herring Gulls* with a few Kittywakes, but the great Black-backed and Ivory Gulls are also there occasionally. Towards the evening, of a quiet dull day, about the middle of March, the residents on the Beach were aroused by the loud trumpeting of a flock of twenty swans, which came up the lake and found rest in the sheltered waters of the bay. That night the condition of every available gun was examined, and a lively attack was expected in the morning, but the swans would not admit of a near approach, and all got off in safety save one, which fell before the rifle of Mr. Fillman. Nearly every season one or two are seen about the same period of the year, but so large a number as twenty had not before been observed.

The past winter has been unlike any other on record for the number and variety of northern birds which have been with us, and also for the number of our summer residents which have remained with us over the winter instead of going south as usual. This can only be accounted for by the fact that in the far north the weather was unusually severe, and the snow of more than average depth, whereas in southern Ontario the season has been the mildest on record.

The foregoing is by no means a full list of the birds which have spent the winter with us, but it may serve to show to what extent the movements of the feathered tribes are affected by the weather, and also how much there is even during the miserable weather of a sloppy winter to interest those whose eyes are open to observe the provision made for these wandering children of nature.

NOTES ON NATURAL HISTORY.

BY MR. WILLIAM YATES.

[These notes were furnished by Mr. Yates, of Hatchley, County of Oxford, Ont., and were read before the meetings of the Biological Section during the winters of 1888, 1889 and 1890. They only partly represent his many contributions, for many brief notes, particularly with reference to the various birds he had seen at different dates, have been omitted. The requirements of the transactions as regards space have also necessitated many omissions, and also a certain amount of condensation, while, in order to maintain the original line of thought, the original manuscript has been also rearranged. However, as far as possible, the original language has been preserved, thus giving an idea of the notes as presented from time to time. It will be seen that they comprehend nearly every branch of the work properly belonging to the Biological Section, while there are also some notes bearing more on Geology or Physical Geography. Attention must also be drawn to what can hardly escape notice, viz., Mr. Yates' great powers of observation, which, assisted by a splendid memory, and united to a wonderful appreciation of the beauties of nature and the lessons to be learnt from the study of its laws, make his contributions most entertaining and instructive.]

After the first autumnal frosts, patches of the Maiden-hair Fern turn white, and remain so for some days, and occasionally longer, if the season prove fine and dry, but soon after assuming this appearance wither away. At this time they present a most beautiful aspect in the dim shades where they are usually found. The Monotropa or Indian Pipe lives and grows in this normal condition of paleness, and at first sight might readily be mistaken for one of the Fungi.

Not far from Hatchley we find many specimens of the Northern Calla, with their noticeable white spathes just above the surface of the shallow water in the boggy neighborhoods where this and

similar aquatic plants delight to grow. Two or three summers ago, many specimens of this Calla growing hereabout produced three perfect spathes and spadices on the top of each scape or stem, and numbers also had two spathes, a state not mentioned in any botanical work that I have met with, and I have never known it to occur except in that one season. I think it was in June, 1885.

Another curious instance of instability in the color of blossom is found in the variations of tint in the Phlox divaricata, which in some of our woods may occasionally be met with bearing flowers of different shades, from deep bluish purple to a nearly pure white.

The occurrence of variegated foliage may also be referred to in the Rattlesnake Plantain, as the Goodyeara pubescens is sometimes called. Few can help admiring the pretty white reticulations that adorn the foliage of this common orchid of our beechen groves.

We have sometimes fancied that, in the case of the Canadian wild garlic, the partial bleaching of the leaves was caused by a sudden fall of atmospheric temperature just short of freezing. But in the cases of semi-albinism in some leaves—for instance, those of the turnip—the white portions are too artistically mixed and blended to permit that assumption to be a tenable one. There, at least, there is palpable evidence of design; nevertheless, utility seems to have been sacrificed on the altar of adornment, as, generally, plant specimens so particularized are infertile, and our attempts to propagate from the seed found in the white blossoms of the Trifolium pratense, and also from the corn with mottled white and green leaves, invariably proved abortive.

At this season, the berries of the Ilex verticillatus have nearly assumed their brilliant scarlet hue, and they add to the attractiveness of a walk on the now dry, peaty surface of the swamps on a fine autumnal day. These holly berries have but a very ephemeral existence, as the hard frosts of early winter cause them to fall from the sprays, and when the December snows have arrived, the branches of this interesting shrub have become bare and desolate. But the haws of the swamp Rose (R. Carolina), which is quite abundant in many localities of Burford, are far more persistent, and furnish nourishing food to many of the birds that stay here all the winter season. The Blue Jays may be seen feasting on these berries frequently in the severe weather of February, and the Cedar Birds, and more rarely the Pine Grosbeaks, may be seen eating them with evident relish.

Another pretty shrub that, at blossoming time, reminded one very much of the European Hawthorn, was once quite abundant in spots not far from here. I allude to the plum-leaved Spiræa, which is now becoming scarce, and seems likely soon to become extinct in these parts.

Also, as the forests are cleared, that interesting shrub, the American Euonymus (var. obovatus), with its brilliant red berries, is much less frequently met with than was the case in former years. We remember, on our first making enquiries as to the name and nature of this noticeable shrub, being assured by some of our pioneer neighbors that it was a connection of the Nightshade order of vegetables, and that its berries were a virulent poison. But this information proved somewhat inaccurate, as many times the Ruffled Grouse and also the Red Squirrel have been seen by our acquaintances carrying off or regaling themselves in the late autumn on the fruit of the Wahoo.

It is a well known tradition among keepers of singing canaries that, to preserve the purity of their color, they need to be furnished with food material of their own tint; accordingly a supply of saffron is placed at the bird's disposal. A trait or habit that we once noticed in a scarlet Tanager would seem to prove the correctness and propriety of this ruse of the bird fanciers. An elder bush whose fruit ripens frequently in the month of June, and is of a fiery red color, was frequented by a Tanager many times in a day as long as the supply of elderberries lasted, although the bird had to traverse the distance of nearly a quarter of a mile to come to its chosen food from its usual habitat in the tall maple woods.

When these parts were first settled (perhaps forty years ago) grassy intervals, styled beaver meadows, were of frequent occurrence and although the herbage was rank, coarse and sedgelike, these areas were valuable, and were mown and the crop taken care of, and used as winter fodder for the cattle of the pioneer settlers, but the experience was general that as soon as the surrounding forest was cleared away, a sturdy growth of willows and cornel shrubs, and especially the red osier and white berried cornel invaded these morassy levels, and nothing short of the axe, and the grubbing hoe, supplemented by the labour of the ditcher, and ultimately by that of

the ploughman, made the conquest over these inveterate natural forces complete.

While walking along the highway through the Township of North Norwich, one day during the past autumn, some peculiarities in the growth of the Solidagos that bordered the roadway, set me thinking about the influence of soil, situation, and drainage on vegetable development. Those specimens of, I think, S. Canadensis that grew in the strong and fertile clay-loam of the district just referred to, had a burly robust appearance, much less tall and devoid of the gaunt scrawny air that seems to characterize their congeners in the more sandy soil and less windy situations, such as when in the shelter of the high rail fences of Burford Townsnip. The floral racemes, one fancied, gave indications of the circumstances or stimuli to which they had been subjected. The denseness and compactness of the flowers on the gracefully moving peduncles had a clotted and congested appearance; and although none of the specimens that grew near the beaten track of vehicles, had an altitude of more than three feet, their stems were clothed with about the same number of leaves that their taller, five to six feet high, nook situated congeners were equipped with.

Then also, it is an allowable surmise, that the influence of surroundings accounts for the fact that the much and slenderly branched form, known as Solidago ulmifolia (Wood) is the preponderant species in the wet and weedy peat boggy soils that occur so frequently along newly made roads in this part of our Province. This species has also fewer root fibres, and is marked by longer and slenderer branches, which probe their way to a share of sunlight, through the interstices of the leaves and branches of the swamp plants and bushes, with which this form has to sustain fierce competition.

The present autumn has been marked by our non-observance of those clamorously, noisy and agitated assemblages of crows that annually occur in semi-wooded districts towards the end of October and that mostly precede the departure of the bulk of the corvine community to more genial climes. Nevertheless several curious traits, illustrative of crow manners, may be perhaps not unfitly alluded to in this note.

One morning towards the last of July (1888), my son called my attention to a straggling stream of crows that seemed to be directing their flight with much cawing towards a point in the adjacent woods, less than half a mile distant, and judging by the continuous corvine outcries that reached our ears, from the objective point of assembly, the inference seemed a justifiable one that there was "some onpleasantness" occurring at the point indicated. So, gun in hand, he promptly sallied forth to investigate. Upon coming up to a large beech tree, he soon saw two crows' nests, a number of yards apart, amid the dense upper branches, and on an adjoining big maple tree three or four crows were cawing very excitedly, and their perturbation was evidently shared in by the continuous new arrivals. Upon scanning the large, high and forking branches of the maple, my son saw a large racoon trying to keep shady and flatly clinging to the side of the big limb with a demeanour that indicated a consciousness of having attained an unenviable notoriety. Two shots brought Mr. Procyon to the ground, to the infinite relief of the sombre-hued birds.

One of our most common impressions when roaming through the primeval forests of this country, has been a feeling of surprise that there should be so few relics, such a meagre amount of debris and refuse material left as evidence of the unremembered centuries that the sylvan garniture is supposed to have been a predominating feature in these regions. Some of the colossal oak trees that are still occasionably met with, give conclusive evidence that no appreciable climatic or topographical changes have occurred during the last five hundred years. Newspaper correspondents have occasionally disputed the accuracy of the testimony as to the age of trees, afforded by the annual rings of growth; but we have a confident conviction, formed after careful experiment and long observation, that such indications in the trunks of exogenous trees are perfectly reliable guides to the conclusions above referred to.

That hackneyed term, "the struggle for existence," conveys too an idea that is incessantly kept before the mind during a woodland stroll, and quite recently, in the course of our occasional experience as woodchoppers, we met with a most striking instance of the formative power of this principle in determining the height and contour of the leafy dome or pyramid of most of our forest trees;

to wit, an immense white oak (Quercus discolor of Gray or Q. bicolor of W.), with huge expanded branches overshadowing a number of neighboring trees. But, in particular, the outline of the dome-like expanse of oak branches had produced such an effect on the growth and development of a vigorous elm tree that was a competitor for nourishment and sunlight at a distance of ten or twelve yards from the oak, that the two organisms wore an appearance and an air of individual, or shall I say personal, hostility towards each other. The oak's attitude and whole physiognomy were very aggressive, like a bully bruiser of the prize ring, with fist extended and ready to plant a knock-down on the crown of his somewhat inferior sized opponent, the elm.

Yet the said elm seemed to be keeping close up to its formidable enemy, and watchfully, yet somewhat timidly, on the defence, with one huge branch thrown upward as an outwork or guard, and flanking skirmisher branches and reserves keeping up touch, but all with a slight leaning backward and expression of fear and indecision, as if it might come to a skip, yet not give in without a tussle.

The fury of the winds and air storms causes many trees to assume traits that one seems almost justified in styling personal. Maples planted in the clearing for purposes of shade in a majority of cases have a graceful inclination in their upper branches towards the north-east, caused by our most turbulent winds, in exposed situations, blowing from the south-west in April and October, when the earth about the roots is apt to be soft and yielding. And it is also well known to such as are observant of natural phenomena, that the direction and force of winds exercise a most potent influence on the base of the trunk of trees, as on all other vegetation, often forming buttresses and obviously bracing thickenings, and even supporting pillars, on the side opposite to that on which a destructive influence threatens the existence of vegetable structures.

In illustration of this view we might mention an incident that years ago came under our notice. We were chopping a fallow, and had a man hired to help us who was an experienced axe man, but who was somewhat illiterate and had not much of idealism about him. Yet on attacking the large beeches or maples with the axe, the roots sometimes hindered us from obtaining level and reliable foothold wherefrom to swing our axes with the most telling effect, and our companion would remark, "What savage holt these trees

take of mother earth," like the talons of a hawk with a deadly grip fixed in its prey. And a poet has said in reference to trees:

> "Their gnarled roots type earnest Will,
> That holds its purpose fast;
> Their ponderous arms may bend, but still
> Regain their place at last."

A remarkable instance of the exhibition of the power of adaptation possessed by trees and herbs in common may be here related. On a piece of moist woodland on my farm a number of swamp elm trees are growing, and these trees, by the clearing up of an adjoining piece of land, became subjected and exposed to a new strain and a new danger, viz., violent south westerly breezes. Trees of this species are rapid growers and deposit woody tissue very energetically; also they have a habit, where the soil is stiff and clayey, of forming roots on or partly above the surface of the ground; and the peculiar efforts put forth by the specimens here alluded to would have convinced the most sceptical mind, as the Comtists say, "That there is an unknowable (not beneficent) Reality behind Phenomena." I myself was stricken with astonishment on observing, two years after, the changed conditions, the enormous development of buttress roots and propping supports that had so opportunely come to the rescue. The effect, to one who so well remembered the original forms of those trees, seemed little less than magical, and I may truly say that the process is going on still, for only a few of the trees have been cut down.

The maize plant (corn) also conspicuously shows wonderful resource in conservation of its living energies. All farmers know that as soon as the corn has grown sufficiently high to be swayed and bent over by the summer wind, hautterranean or above-ground roots emerge, two or three inches above the surface of the soil, from the stalk of the plant, and descend into the earth. They act and serve the purpose of hawsers and guy ropes, and give a firm basis to all the stalwart species of the Gramineæ or Zeas. Under some conditions, such as in instances of rank tall growth, and on exposed hills, some of the cereals, as wheat and oats, exhibit the same self-preserving device. This we assert from personal observation too; in fact, "*Ex uno disce omnes*," if it exists in one, it is inherent to all.

Workers in a maple sugar bush are often puzzled to account for this circumstance, viz., that when a maple tree leans towards the

north-east, if you tap the same on the south-west side, comparatively little sap will be obtained. Or if the tree leans towards any other point of the compass the same rule is to be observed, the fluid currents are most copious where the deposition of woody fibre is most needed for the preservation of the structure. Some aver that mere gravitation sufficiently accounts for the fact, but the true cause seems somewhat obscure, as well as those causes that concur to influence the activity of the sap currents in certain meteorological conditions.

The peculiar sleety storms that sometimes occur in midwinter in these latitudes, and that clothe everything out of doors in a thick coating of ice, frequently prune and mutilate the forest trees with great severity, and large trees occasionally become bent, and their large branches wrenched out of symmetry on such emergencies, and the form of their boles so modified that their outlines in anteglacial times are only "things of memory."

Woodsmen find but little difficulty in identifying, even at a distance, the various species of deciduous trees, even in winter, by the curves or angles of the smaller branches or sprays. Those of the oak have a sturdy, continually repeated curve, and thickened, pronounced bark. Some aver that the angles that are made by the junction of the maple sprays are the same angles that are indicated by the midveins and veinlets of the leaves; oak spray curvatures answering to the sinuosities on their leaf margins. Maples, however, when planted in open places, generally assume an oval form in the outline of their branches, and exhibit many exuberant and seemingly independent centres of growth, similar to those well rounded, ebullient forms of dense vapor seen in cumuli clouds on a fine summer day. And in very truth, wherever the maple forest abuts the clearings in a straight line, the bold, heavy, richly rounded curves of the foliage tops seem to find their counterpart only in summer cloudland, or else in memorable paintings one has somewhere seen, representing mountain heights, such as the Tyrol, with an infinity of sky for a background. Only a photograph could convey an adequate idea of the so-called mental attitude; "*Nulla planta sine anima*," said Aristotle, of the two trees mentioned above. Everyone gave a smiling assent to the idea of two combatants, when drawn to notice the symbol in woody fibre. My two sons chopped down the big oak. It was five feet and more in diameter at the

stump, and we counted 380 distinct annual rings. There was a decayed hollow at the heart one foot in diameter. We found a living swarm of bees in the hollow crotch, and there were racoon debris and pheasant roostings in part of the hollow. Reference also might be made here, when speaking of the attitude of these trees, to a couplet in Pope's Windsor Forest, where the text reads in some versions :

> **"Tall trees arise that shun each others shades."**

But in a recent American reprint, the twenty-first line of the poem is thus given :

> **"Thin trees arise that sun each others shades."**

In taking note of changes that, since the year 1850, have taken place in the channels and banks of some of the streams that diversify this district, a clue is afforded towards tracing the cause of the peculiarities of contour and erosion-marks, that seem to have been brought into existence long before the advent of the white man.

In the outline of the western bank of the Grand River, less than a mile above the City of Brantford, extensive erosion by the impact of floating masses of ice during the floods at the breaking up of winter has been accomplished since the date above mentioned.

The slightly undulating surface of the south-west part of Burford Township is drained by Big Creek, that enters Lake Erie in Long Point Bay; and near the Village of New Durham, a survey of the course of this stream forces the inference that the volume of water once flowing lakeward between its banks must at some former time have been much greater than what we witness at the present day. For a stream, now only a few feet wide, meanders through extensive flats that are inclosed by banks that in some spots attain a height of 50 to 60 feet. These banks doubtless formed the shore of the ancient stream, and a line drawn diagonally across the bends of the creek strikes points where the argillaceous banks rise abruptly and nearly perpendicularly from the surface of the waterflow, and thus attests, in a convincing manner, that the impact of floating ice, which, through its acquired momentum, disregards curves in the streams, but strikes forcibly the steep shore, was impelled diagonally down stream to the opposite side, where its delving and disintegrating action was repeated. In those parts of the stream that are

situate between the points struck by the floating ice at the bends, the shores, though equally high, slope gently to the water's edge.

Many of the swales and morasses, whose surplus waters find an outlet to Big Creek, give indubitable evidence of having once been ponds or shallow lagoons, that in course of centuries have been gradually filled with indrifting and decomposing vegetable matter; also that their waters attained once a higher level than has been the case since the bush was first settled by white people. In connection with this idea one may as well mention here an illustrative incident. During the past dry summer (1888), a bush fire raged for a number of weeks in a partly cleared, extensive tamarack swamp. The three or four feet of black, superimposed peat was consumed by the heat and the resultant ashes were blown away by the wind. The unconsumable, sandy bottoms of the bog presented an interesting appearance and reminded one of the uneven, eddy-worn surface of a foreshore or muddy margin of the ocean, at some spot where the tide had lately receded.

On one occasion, whilst lately watching some ditchers at work in the above swamp, it was noticed that a large portion of the rotten vegetation, cut through by the spades of the workmen, consisted of the still easily recognizable roots of Menyanthes trifoliàta, although in late years the watery element had not been in sufficient predominance for that plant to flourish or exist in much profusion.

The peculiar lofty knobs, mounds or isolated knolls that dot the slopes of the Grand River valley a mile above Brantford, and also occurring along the Mount Pleasant valley, are remarkable geologic phenomena, and have worked much curious speculation as to the agencies which aided in their formation and moulding.

The extensive levels known as Burford Plains, a rich, loamy area, 5 or 6 miles in diameter, resting on 50 to 60 feet of nearly horizontal beds of rounded gravel, said gravel strata reposing on the glacial or indurated boulder clay, have very distinct topographical features compared with what is known as the Burford timbered lands. The limits are defined by hilly land and ridges of mostly heavier soil, and the glacial clay is generally struck in digging wells on the timbered portions of Burford at a depth varying from 12 to 20 feet. The flora, too, changes abruptly, and in an unmistakable degree as the dividing line of the adaptations is crossed.

The hydrographic changes induced by clearing and cultivating

the land, in the regions about the sources of the Grand River, have been commented upon by the most indifferent observers that reside in this district, and have proved a source of much embarrassment to mill owners, bridge builders, etc.

The evidence seems pretty strong that Burford Plains were once covered by fresh water, the drainage of which seems to have been accomplished through sluiceways, marked now not far from where White Man's Creek joins the Grand River about five miles above Brantford city. And if, as some geologists assert, Lake Erie was formed by a rather sudden subsidence, the most of these lacustrine changes, including the formation of the isolated mounds, could be perhaps easily accounted for.

Since the acceptance of the theory of a glacial epoch by geologists, surmises have been put forth that a majority of our swampy depressions are the result of stranded ice masses melting slowly when surrounded by eddying volumes of fresh water. And if the formation of moraines gives any corroboration to such conjectures, it may be adduced in evidence that ridges and isolated heaps of rounded gravel are very frequently met with on the margin of our black ash and other swamps. One particular gravel mound of this kind occurs near here; the mound on the side toward the west sloped gently to the general land level, while on the side adjoining the edge of the swamp the heap of small rounded stones and coarse sand had a perpendicular face of thirty feet or more. The said mound was purchased some twenty-five years ago by the Municipal Council of Norwich Township and teamed away to improve the highways.

After a rapid winter thaw the waters of Big Creek swell to something like what have been assumed as prehistoric dimensions. Then frequently intense cold immediately follows and ice more than one foot in thickness covers the wide expanse. Towards spring another thaw accompanied by heavy rain is inaugurated, the ice breaks up and is piled in huge chaotic masses near some gorge or narrowing of the vale, and soon some of these jams are put in motion, and with irresistible force occasionally strike the shore or some slight eminence on the flats of the valley and carry off masses of earth, stone and sod, to considerable distances. Three years ago about an acre of rich meadow land near here, was stripped of its sward by a sudden break-up of this kind. These changes taking place before our eyes,

demonstrate the efficiency of similar elements on a vaster scale, in pre-adamite days, to plane down the rugged hills and to prepare the earth's surface as a dwelling place for intellectual beings.

Since the violent windstorm, accompanied by a fall of 5 or 6 inches of snow, that prevailed last Thursday morning (Jan. 10, 1889) large flocks of snow buntings have frequented our fields. And a curious trait that I have never seen mentioned in the books, has been again and again noticed in connection with these birds, namely, their nocturnal habit of feeding. Last Thursday night a flock of several hundred was seen by my son. The birds were passing just above the rather weedy surface of one of our fields, in loose go-as-you-please order, many of them occasionally alighting on grass panicles or dried stems of clover just above the slight covering of snow, the hour was about 10 p. m., moonlight but cloudy. Another large flock was seen next night near by under nearly similar conditions. Five or six years ago, I, one night, found myself in the midst of a flock of these birds, which were in scattered order, feeding in their normal way, although the hour was 7 p. m. in the month of February. Have they acquired this habit during their supposed residence in the twilight of the Arctic latitudes? That they fly and feed by night is now indisputable.

Having, not many months ago, to undertake the work of excavating a cellar under a portion of my dwelling house, I happened to become aware of facts and circumstances that convinced me that there is any amount of Philosophy connected with tree root development. The substance, dug through to the depth of five feet, was a very solid mass of reddish brown clay, very difficult to penetrate even with a newly sharpened pick. Yet into this compact stuff the roots of an apple tree, that was growing at a distance of about ten feet from the edge of the excavation, had thoroughly penetrated in every direction. Many of these roots were nearly of the thickness of an ordinary walking stick, and were of a wavy or spiral form, somewhat resembling one of the strands of a rope that has been untwisted. These roots must have insinuated themselves into the hard clay when very small, mere hair-like fibres, and then by secretion of vegetable sap reduced or dissolved and absorbed that portion

of the matrix to be occupied by the enlarging root. This theory, however, is only suggested for whatever it may be worth; any other explanation seeming beset with difficulties, for when portions of the roots were forcibly pulled out, the tunnels they had occupied remained intact, and the theory of mechanical uplifting force seems untenable.

Also, in digging holes into very dense strata of clay or marl, to the depth of four feet or more, the roots of the common elder shrub are frequently met with. Their power to burrow and penetrate into such intractable substances cannot fail to excite feelings of surprise. It is well known too, that the Canada thistle roots have the faculty of travelling extensively at a depth of two or three feet underground, through the hard-pan subsoil. The roots frequently encroach in this way from the fields of a negligent, weed-permitting farmer by underground approaches, thus dodging the boundary fence and appearing again, or rather pushing up their superstructure in the field adjoining. These thistle roots too have the same auger-like form, and as no chips or borings are ever visibly left behind in their onward march, the theory of absorption and assimilation seems plausible.

When noticing these things, and similar almost unaccountable phenomena of vegetable growth and life, in the midst of summer fields and farm labor, we have sometimes felt inclined to ask the question: "Is there an extraneous force of Will which acts on matter in derogation of laws purely physical, or alters the balance of these laws among themselves?" (Gladstone.)

For instance, in the common unromantic work of thinning out turnips, if in the usual haste of this occupation one plant is not removed far enough, a single fibrous root, all but invisible in its gossamer-like tenuity, remaining to connect the plant with its former place in the earth. In spite of the scorching rays of a July sun the said plant is preserved from withering, and although its congeners, whose connection to mother earth has been totally severed, are withered to nothingness in a few hours, our plant, with this slender umbilical connection, will live and thrive, soon throwing out auxiliary roots, which go down into the soil, and so the organism is preserved and succeeds in becoming a continuer of its species. So, in such instances, we see that plant-life is not pulseless, and we can hardly conceive the activity of the vital currents that must pass to and

fro through the spider-line connecting link to support exhalation and inhalation in that heated and arid atmosphere.

In short, in many experiences about the growth of shrubs and vegetables, there are reminders of the methods and resources that inhere to animal existence. Thus we see, in the cultivation of many edible roots, that when such meet with accidental injuries, as from the gnawing of mice, or bites of trespassing animals, a prompt healing process sets in that is thoroughly remedial in its nature. Cellular growth becomes very active, similar to that occurring on the surface of the animal body after a burn or scald, and the vegetable organism, though somewhat deformed in shape, accomplishes the principal aim of its existence. On the other hand, when the nourishing underground fibrous appendages meet with bruises or abrasions, speaking of the mangel or turnip, there is a tendency to the production of tumors and unsymmetrical, wart-like accretions.

It is probable that departures and deviations from regularity of structure are of more frequent occurrence than many are aware of, as few are sufficiently observant to pay attention to such objects, or to report them. Only a few days ago I was invited to go and examine a peculiarity of development in a tomato plant which was described as having fourteen or fifteen ripe tomatoes all massed and united on the top of the stem, which, like the thistle curiosity, was devoid of branches, and an instance of the preponderance of the centripetal action on the structure.

The opposite tendency is the normal one, and can be detected in the branching sunflower, Helenium divaricatus or multiflorus, which we sometimes see growing wild in low sandy woodlands around Otterville. And occasionally in forest trees, when the first stem has been accidently bruised or destroyed, a number of offshoots branch from the crown of the root, and instead of one towering stem, eight or nine will immediately succeed to the function of the exterminated one.

Experiments with a view to test the morphologic powers of many of the hardy, weed-like plants would yield interesting, if not profitable results.

Lesions in the vegetable tissue are sometimes the result of bruises from the tramping of animals, and there is room for conjec-

ture whether, in the instance of the changed thistle growth, as the sample grew in a pasture field where horses roamed, the abnormalities had or had not been caused in that way.

One of my acquaintances was lately speaking to me about the unusual annoyance that he has lately suffered whilst ploughing up a rough piece of land for winter wheat, that had become much infested with colonies of humble-bees. These attacked and infuriated his plough team, so that he was compelled to go to work and destroy all the nests and exterminate the bees. Many of the nests he described as being of the size of his two fists, and often containing a pound or a pound and a half of pure honey.

A young man, who was picking berries, about six weeks ago, called my attention to several bees that had alighted on the edges of the leaves of an elm tree that grew near the spot where we stood, and under which some fine growths of Canadian golden rod were in full blossom. Upon capturing several of the bees they made a loud, angry buzzing, and assumed violently belligerent attitudes, but my friend assured me that however unquakerish in disposition, these bees had no stings, and that many children fearlessly handled them.

I noticed that several of the bees were loaded with the rich yellow colored pollen of the solidago flowers, and this fact seemed to make dubious the proposition or rather supposition of my informant that these individuals were drones or males of the humble-bee perched on the leaves of the elm as an advantageous look-out point for the queens of their species.

A curious instance of Parasitism in a dual form came to my notice twelve or sixteen days ago; that is, if we are to class the birds of prey as parasitical on animal life in the lump.

Here, close to our house, during the last of October, we were troubled by predacious nocturnal visits from the large horned owl, Strix Virginiana, to our hen roosts, so my son tried to capture some of the marauders. A reliable steel trap was set on the summit of a thin pole, erect and about thirty feet high, near the poultry roost, and one dark night soon afterwards, or rather among the sma' hours of the morning, a rather dolorous piece of bird minstrelsy smote upon our ears and awakened us to the consciousness that our trap

had embraced Minerva's representative fowl, who persistently, at brief intervals, voiced the syllables, to hoot, to hoot, to hoo. This signal of distress was soon responded to by an accomplice owl, who came and perched on a small tree at a distance of about twenty feet from his manacled coadjutor. The alternate outcries of the uncanny musicians continued for an hour or more, until dim dawn announced that the vanishing hour had arrived for spookish birds and spookish bird-notes. At this juncture my son went out, gun in hand, but the unimprisoned bird took a very precipitate departure, seeing that his unfortunate mate was past solacement, if not past praying for; No. 1 bird was now lowered, taken in and done for. It was a handsome sample of his kind, and his beautiful plumage and powerful adaptations were looked upon with a shuddering interest.

Here is the fitting place, perhaps, to allude to the circumstance of these powerful carnivorous birds being much infested with insect parasites. On preparing the body of this particular owl for taxidermical purposes, quite a few hemipterous creatures were found at the roots of the feathers, adhering by their suction tube or proboscis, and in a more numerous group near to the anus of the victimized bird. These insects bear a strong resemblance, in form and size, to those entomological pests that annoy the ovine race and are very commonly known as sheep ticks. The only obvious differentiation is that the owl ticks have large membranous wings. Years ago we had noticed that the large horned owl is much infested with these flying ticks, sometimes in great numbers, and sportsmen, who are close observers, and whose testimony is valuable, assure us that the common partridge or ruffled grouse, Tetrao Umbellus, is troubled and infested frequently by a winged tick that, to an ordinary eye, bears a very strong resemblance to those by which the owl's body is depleted or preyed upon.

Insects of that particular order are supposed by many to delight in forests, and decaying wood and leaves, as breeding places. We have frequently ourselves found a large bluish white tick pertinaciously fastened into the neck of the black and red squirrel; and not very rarely have found the common woodchuck or Canadian marmot similarly unwillingly appendaged and preyed upon.

I am also assured by some of my intelligent neighbors that children, after walking or playing in the primitive woods, frequently return home with tick-like creatures adhering to the bare parts of the

body. Little girls, whose arms and necks were generally bare, are especially liable to this unwelcome but seemingly painless annoyance. One mother of a family assured me that in summer-time she always had to examine the children carefully on their return from bush errands to rid them of these pests, as the little folks seemed unconscious of the insect intrusion.

The books most available many years ago to persons contemplating emigration to Canada, gave the assurance that no apprehensions need be entertained on the score of noxious reptiles. It was therefore with surprise that, on settling in the County of Lincoln, Niagara District, we learned from old residents that venomous rattlesnakes still infested the borders of swamps and the banks of streams, and were not to be recklessly intruded upon. Although, fortunately, during the summer of our residence there, we never interviewed one of these dangerous ophidians in the course of our frequent rambles, it was demonstrated that they were far from extinct by the number of people one met, who had the almost indestructible memento, the caudal rattle of the horrid reptile, in their possession, and kept it to exhibit to all who took an interest in such objects. A majority, too, of the inhabitants were very reluctant to travel along the forest paths after nightfall, and warned us to be very circumspect under certain conditions, and to be on the qui vive for the admonitory rattle. There was also a widely entertained belief that the hog was a formidable enemy of the rattlesnake, and would ultimately be an important factor in its extinction in that district. Such a belief seems to be well founded, for more than once we have seen the hog, when grazing, suddenly become aware of the presence of a garter or a milk snake, when he would become obviously enraged, and the chase and speedy destruction of the ophidian would result.

What chiefly renders the rattlesnake difficult of extinction in certain parts of the west is the presence of rocks on the earth's surface, whose fissures and crevices afford winter shelter and harbor, from which expulsion is an impossibility.

Another surprise to British settlers, on their advent to this country, was to observe the large proportions and girth of the common black snake of North America when compared with the common meadow snake of England and Scotland. During the hot

weather of July or August, in Ontario, it shows a penchant for frequenting the heated dust in the middle of the public roads, where we have frequently seen them. They are then in no hurry to escape when approached by an enemy, but seem to be in a state of drowsy enjoyment of the dust and the sun's scorching rays, and they often come to their death by being crushed by the wheels of passing vehicles. Some idea of the size of these snakes may be formed from the statement, that while often seven or eight inches are cut off or crushed by the wheels at one side, from the head end, as much of the opposite extremity is cut off by the wheels in the opposite ruts. This species of snake preys much on small birds, and persons engaged in raspberry picking, in July, in this neighborhood, are liable to unpleasant surprises by the movements of these snakes when twining about the shrubbery in quest of the birds, which come in numbers to feast on the berries at that season of the year. An acquaintance, a few years ago, while engaged with his sister in berry-picking, had an encounter with a black snake over six feet long. When first seen it was descending from among the branches of a Juneberry tree, Amelanchier, that grew amidst a dense clump of raspberry bushes. By cudgelling and shouting, my friend drove the snake out of his ambush, and when on clearer ground, encouraged his large dog, Bounce, to assist in the battle. The dog, nothing loth, closed on the fierce looking antagonist, who had erected himself on his nether extremities, but Bounce, with his teeth, grasped the snake savagely by the neck, when in an instant, Boa Constrictor like, it twined its body in several folds around the chest and ribs of the dog, which soon began to show signs of embarrassment and even panic upon finding itself thus tightly enfolded. He then began to jump up, bounding from the ground all four feet at once, but the snake refused to relax his spiral entanglement until the dog's jaws had loosened, when, in its attempt to regain the shelter of the bushes, it received a crushing blow from a stout stick in my friend's hands, which rendered further resistance feeble and of little effect.

Men who have been employed in the Hemlock woods in this township, bark-peeling in the heat of summer, tell of meeting with black snakes of incredible size, as thick as a handspike and between eight and nine feet long. Not a summer passes without my having brought to my notice one or several which measure over six feet. They are supposed to winter in burrows made by the marmot or

ground-hog, just deep enough in some dry sand or loamy ridge to be out of the reach of severe cold. About two years ago, some acquaintances of ours who were engaged digging out several badgers, skunks, which had sought a temporary refuge in a woodchuck's burrow, found a black snake of average size occupying a space in the deepest part of the excavation. His snakeship was reported as showing symptoms of languor, but was by no means in a torpid state, though the season was January and wintry snowstorms raged above ground. No unfriendliness was manifested moreover among the strange denizens of the burrow.

Mention might also be made of the alleged proclivities of black snakes for going into the water in pursuit of their prey, it being frequently asserted that this is a custom of theirs. Some of my acquaintances, however, say that the species most commonly seen in the water is somewhat darker in color than the variety most generally found in dry situations. At any rate, snakes larger than the milk snake, and of a very dark brown color, with almost an absence of striped markings, have been often seen by us pursuing and capturing the common crayfish that inhabit shallow streams and ditches. It is mostly the smaller fry of the crustaceans that they capture, and when they have seized one they generally go out of the water to some lurking place, under a log or stump, to enjoy their meal. Near these spots, the debris, consisting of refuse fragments of the young crayfishes' shelly covering or nippers, gives evidence of what has been going on.

The black and other snakes can move with considerable speed in the water, but their motions are undulating and have not quite the directness or celerity of the finny tribe.

Some years ago, my brother saw a large black snake pursue a frog, which took refuge in the water of a creek near by. He struck the snake with his fishing rod, severely bruising its body, as it swam on the surface of the stream, and the blood, which flowed from the wounded ophidian, was in such quantities as to redden the water for the space of several yards around.

A curious belief among bush workers is that the common bird eating black snake has a habit, when up among the tree branches in orchards and other similar places, of springing by bounds from branch to branch across an open space, and some individuals have assured me that they have repeatedly seen such a feat performed by it.

The reptile that is most noticeable in its coloring and brilliancy of skin adornment among the species of its kind, and most frequently met with, is the one known as the spotted adder or milk snake. The upper half of the milk snake has a series of saddle-shaped, dark brown spots, the whole length of its spine, on a light greenish ground, also along the sides an equal number of round or roundish dark brown spots, graduating in size, like the saddle-shaped ones, according to the tapering of the snake's body. A band of black runs around the margin of the upper jaw, which, with the sparkling and restless glare of the eyes, gives an expression of peculiar malice to this much hated snake. The under parts are beautifully chequered with blue and silvery white scales, and the purity of coloring and contrast always makes this snake an interesting object to observe. Although by no means scarce here in warm, moist summers, they are less frequently met with than the common garter snake, from which they do not differ much in point of size, although the milk snakes are slightly the larger, about three feet is the average of such as it has been our lot to meet with. It is oviparous, and we have occasionally found their eggs deposited in ground-squirrel burrows in sandy spots beneath the blackened roots or stumps of the pine tree, there being twelve to fourteen eggs.

Although there seems to be ground for supposing that some snakes have a relish for milk, there seems but little reason for the common traditions as to the milk snake's methods of obtaining it from the cows. The milk snake delights to inhabit an old straw stack near an old barn, and often deposits its eggs in such a place in hot weather. And as milch cows are also fond of reposing there to ruminate during summer nights, while, before arising to their feet in a morning, milk drops may be seen oozing from the distended udders, snakes, if in proximity, would naturally imbibe the liberated and nourishing fluid, and hence the tradition.

The milk snake also delights to haunt outside cellars and root houses, and a friend of mine, the wife of a new settler in the woods, upon going into her out-cellar on one occasion, was astonished to see a snake raise its head and neck above the surface of a tin pan full of new milk. Whether the warmth of the liquid had suggested to the reptile the desirability of a cosmetic bath, or the nutritious and palatable qualities of the fluid had been the temptation, may be a subject for conjecture.

Milk snakes also climb into bushes to rob birds of their unfledged young. Two or three years ago, my brother, while hoeing in his garden, heard cries of distress from a pair of bush sparrows that had a nest full of nearly fledged young ones in the forks of a bush near by. Upon going to the spot, a large milk snake was seen twined around the stem of the small tree, with its head raised just above the young birds, as if in the act of selecting the best one for his next victim. He at once killed the snake, and on opening its maw, found a young, recently swallowed bird and a half grown field mouse. In August, three or four years ago, my son, while ploughing a summer fallow, chanced to overturn the last fangs of an old pine stump, under which he found fourteen snake's eggs. They were rather larger than robins eggs, obtusely oval in shape, and with an outside resembling parchment in color and consistency. Upon giving one of them a rather rough shaking, it divided symmetrically by a line circling the small diameter, and a perfectly formed young milk snake, eight and a half inches long, emerged. It was interesting to see how neatly and skilfully the young ophidians were spirally coiled in their parchment-like integument, so that, at maturity, they had to exert but a little muscular force or contraction, when lo, the integument divided into two neat little leatherlike cups, and the whilom prisoner was free and as full of life as a young rooster chicken. It seems to be the habit for a brood of young snakes to keep near together for a considerable part of the first summer of their existence, for about three weeks after uprooting this nest, a group of young milk snakes was found. They measured eleven and a half inches in length, so had grown three inches in as many weeks.

The milk snake has the reputation of being one of the most agile of its tribe, and I have heard of their being found pursuing mice among hay or sheaves of grain mowed away in barns. Those who saw them believe that they had crawled up some angle of the boards that enclose the sides of the barn; however this may be, it is certain that the muscular energy that controls the scaly covering of the underside of the snake's body gives them power of rapid locomotion, as well as power to adhere to narrow surfaces. One acquaintance told me that he saw a milk snake moving rapidly along the edge of an inch board that formed the upper board of a straight fence, near one of the posts of which a peeewit flycatcher

had built her nest, and that when attacked, the snake scooted along the narrow board edge faster than he was able to walk.

The caudal termination of a milk snake is a hard, horny point, and it is averred that this is used as a means of defence, and that when this or similarly equipped ophidians are teased with a pine shingle, they will strike it with such force that the armature pierces the wood and is difficult to extract.

It is a common belief that the garter snake lays eggs, but Dr. Garnier's testimony proves this to be an error, while I myself once removed eleven young ones from the abdomen of a female garter snake, which I was convinced had never seen the light of day, and I felt sure that the garter snake was occasionally viviparous at any rate.

The garter snakes seem gregarious when hybernating, and I have found them occasionally ten or twelve together in underground holes near a morass, where they would surely be frozen and also surrounded with ice in wintertime. Like the hybernating quadrupeds, the ophidians are quick to perceive the genial influence of Spring, and on warm, sunny days in early April, and even sooner, crawl out of their winter retreats to lay coiled in a southern exposure and bask in the solar rays, even when the remains of deep snowdrifts exist only a few feet distant.

The garter snakes, like the milk snakes and others, are particularly gregarious in the earlier part of their life. On one occasion I found, on removing a pile of boards, thirteen half grown garter snakes, in a space not exceeding two feet square, luxuriating in the warmth in various curves and bendings of their elongated bodies, with the seeming sociability of a Quaker meeting. They had evidently assembled from a piece of fallen timber land adjoining.

I have occasionally witnessed the exciting chase of a garter snake in pursuit of a frog, the latter making its best jumps, and the snake, with elevated head and glittering eyes, watching for the opportune moment to strike in decisively. Sometimes the frog, as if paralyzed, rests for a moment amid a tuft of weeds, with flanks panting in abject fear, the snake gazing at the exact spot intently, and on the slightest movement of its victim, making the deadly spring, which closes the batrachian's career. When the chase is downhill, the frog sometimes escapes, and if a stream or a ditch or puddle be near, directs its course thitherwards, dives at once to the

bottom of the water, and instantly stirs up the mud, roiling the water as much as possible.

The garter snake is quite commonly captured in the summer with an unsightly protuberance in some part of its body, from which is extracted an undigested frog or even an unlucky toad. On one occasion, a friend assures me, he liberated seventeen vivacious young garter snakes that had evidently in a moment when threatened by danger sought safety in the parental interior. The young milk snakes have also been known to seek a similar place of safety.

Ophidians are quite often found in proximity to putrefying animal substance in the fields or forest, but whether in quest of the carrion loving insects or beetles that are attracted to such spots, or to regale on the substance itself, seems not very clear.

Like all wild animals, snakes assume a bold and defiant attitude when a seeming danger threatens the safety of their immature young. On one occasion, as I was busily engaged thinning and weeding field carrots which had a dense growth on top, I found myself, as I was stooping to the work, suddenly confronted by a semi-erect and evidently irate garter snake, with mouth open, head swaying, and tongue flickering, whose privacy had evidently been trespassed upon. I instinctively drew back and the snake ceased its belligerent demonstrations, and was soon lost to the eye amid the rank vegetation. A friend, to whom I narrated the circumstance, suggested that the snake must either have been disturbed when taking care of its young family, or else had been contemplating a speedy change of its scaly integuments, at which times, he averred, the serpentine irritability is excessive.

Snakes quite frequently fall a prey to the falcon tribe. When the latter are hard put to it to obtain a sufficient supply for their clamorous young, it is not an unfrequent spectacle in summer to see Falco nilvus, or hen-hawk, fly overhead with a snake in dangling contortions grasped in its claws, and steering in a direct line towards its hungry and screaming young ones.

All the snake family are fond of warmth, and we have frequently found them enjoying the artificial warmth of burning log heaps in the chilly air of early morn. The largest gartersnake I ever met with was found burned to death in the hot ashes resulting from a heap of burnt logs. The season was the month of April, and the snake seemed to have approached the genial warmth too

near during the darkness of the night, and on feeling the painful heat, instead of retreating had dashed right onward into the burning embers, and its crisp and contorted form in the morning bore evidence of its painful death.

There is a curious belief among some Canadians concerning a snake that they name the hoop-snake, which it is asserted has a habit of bending itself in the form of a hoop by placing its tail in its mouth and trundling along with greater speed than a man can walk, and it is earnestly asserted that the best way to get out of the way of these hateful pursuers is to walk around a tree, as these snakes can only make good headway in direct lines.

Another native ophidian, that seems to have given rise to a number of vague, and perhaps, somewhat mythical traditions or beliefs, is the Puff-Adder, sometimes called the Blowing Adder. This species is said to have been numerous thirty or forty years ago, but I believe is now rarely met with. It is, however, credited with having the power or habit of inflating the forepart of its body and emiting a blowing, defiant sound, when disturbed, something like the Cobra or Hooded snake of the East Indies. I have only seen this reptile once, although I have walked quite a distance on several occasions, on purpose to see one or gain information, but was generally too late to gain much satisfaction.

The one I saw was noticed on a hot day near the end of May, a number of years ago; it was lying in a roadway that led through a swampy thicket, and had evidently been killed an hour or two before we found it, as putridity was commencing in the hot sun, so that the body probably was more or less bloated. The snake had a rather small and tapering head, the body was of a sombre color, very thick in proportion to its length, being about as thick as a man's wrist, and much less tapering towards the extremities than ordinary, though this may be accounted for by the bloating referred to.

These snakes are said to be generally found, as this was, near small streams, and to live on the small amphibia as well as on insects, this one was probably crossing the highway from one part of the swamp to another, when killed.

A neighbor of mine killed a Puff-Adder near the town of Norwich, Ont., a year ago last August. It was crawling across the road, and appeared to have come from under the sidewalk. It had, he

said, a most repulsive look, and when attacked assumed the spiral attitude.

It was of a slate color, with lighter chequerings, had a broad head two inches wide, large eyes, a length of about two feet three or four inches, and body very thick. The caudal extremity was very blunt, shaped like the end of a man's thumb. It had a number of teeth, and not microscopical ones either, and a gape of mouth that could have found little difficulty in swallowing a common barn-door fowl's egg.

The little ringed snake, Diadelphus punctatus, which, according to Dr. Garnier, is viviparous, is hardly ever seen over twelve inches long, and is invariably found in the interstices between the loose bark and wood of decaying logs in the bush. It feeds on the earwigs, small beetles, and other small insects that harbor in such situations.

Many hints and suggestions come to the front whilst following one's ordinary avocations, and sometimes lurking and elusive truths become manifest and give rise to a train of constructive thought. The other day, while felling and splitting up a large oak tree, a peculiarity of growth was observed in the timber that characterizes a certain percentage of the oak trees. In splitting the trunk, the surface of a section, from the circumference towards the heart or centre of the tree, presents a rippled or wavy surface instead of the even flat cleavage so much desired by mechanical workers in this kind of wood. The fibres, instead of the direct upward tendency usual in symmetrical or free-splitting trees, are interlaced and woven in amongst each other, giving to the wood the character known as gnarliness. The object seems to be to give the tree the maximum of power to resist strains, and the stress of adversity, such as winds and blows from falling trees, that may go down or be overthrown in the vicinity. This peculiarity of structure would seem to show that a tree represents a dominant idea that is superior to the lapse of time. For the unity, comprehensiveness, and integrity of design, are imbedded in the cotyledon from the first sprouting of the acorn, and are unvarying through the centuries clear to the solidification of the last layer of sap deposited on the terminal sprays of the summer of 1889, the pertinacity and fidelity seen in the adherence to the generic formula of growth being remarkable in these samples of

oak. And if we look at the crest of one of the undulations, that twenty annual rings of growth are requisite to form, twenty more years having to elapse before the rhythmical depression of the curve line is produced, the patient and unostentatious carrying out of purpose here evinced can scarcely fail to give rise to emotions in one's mind akin to the reverential. For do we not see the workings of a principle, or a beneficent, conserving energy, to which the amplitudes of space and time are but toys?

Most of the large oak trees illustrate what has been written about as the spiral tendency of all vegetation. Many have the twist in the direction of the sun's motion from east to west, and then the spiral becomes more pronounced as the trunk ascends. But sometimes the spirals run up the tree in the opposite direction, from west to east, and then, as a rule, the spiral tendency diminishes towards the tree top, this being the reported opinion of woodcutters and foresters in this country.

The sap, in ascending, seems to tend to the same vortical motion as an upper eddy of wind or a waterspout. The uprising sap seems to move by pulsations or throbs, and like all moving liquids seems to flow easiest in undulatory lines. In many trees the undulations are external deviations, or crossings of the perpendicular line of ascent, as if in hesitancy which spiral course to follow. There seems to be a centripetal tendency in the spiral growths, and the trees with twisted trunks, which have usually numerous, but not very large branches proportionately. Those that have straight grained stems, and which can, most of them, be split with ease, are generally bifurcated near the top of the trunk into two very large branches, which with their sub-branches form the tree top, and in these the centrifugal tendency seems to have preponderated.

Curious woodlike malformations are sometimes formed about the roots of beech trees, which have assumed fantastic forms. In several instances the flattened masses, in their foldings and size, bore a striking resemblance to a mass of eviscerated animal entrails, with all the imitations of the mesenteric puckerings. These accretions first seemed to be a sort of ligneous fungi, but they were covered with bark similar to the trees at whose base they had grown, and consisted interiorly of a hardish grey substance, somewhat softer

than the natural beechwood and without its fibre. They seemed to have grown from exudations of beechen sap, from wounded buttresses, or above-ground roots of the trees to which they were attached, the trees themselves still growing and thriving.

Among the various species of fungi found in Canadian forests, one appears on decaying, prostrate tree trunks in moist summer weather having a gelatinous or soft leathery appearance, looking like tripe, and in masses that would often more than fill an ordinary pail. Stray horned cattle search for them and devour them with great eagerness.

Another interesting species, the edible morel, which used to be found in considerable abundance about the roots of rock-elm trees that had been killed by the woodman's process of girdling, were only to be found during the last half of the month of May, and only in the early stages of the decay of the tree under which they grew, as if favored as to growth conditions by the decomposed sap in the roots of the tree. They are yet occasionally found about the roots of apple trees in old orchards, and especially about trees that show signs of decadence and of having seen better days. These morels are carefully gathered, when found by knowing ones, are quite wholesome, and when properly dished up are a real delicacy, and are justly relished by epicures.

A relative of the toadstools, less welcomed when met with, is sometimes discovered among the rank grass around old fences in the autumnal months, its proximity being sometimes made known by the number of buzzing flies, attracted to the mephitic production by its powerful putrescent odor; it is known as the Phallus. It resembles the toadstools in its mode of growth, but the pileus or cap is very much the shape of the old candle extinguisher.

A peculiar effect was noticeable in the fall of 1889, so peculiar for its long succession of clear sunny days, in the tinting, with red or maroon, of the usually white flowers of Eupatorium perfoliatum. A large proportion of its white cymes assumed these hues towards the end of September or beginning of October, and the fact attracted our attention that such specimens as were found growing in the shade of woods, as a rule had been able to preserve the whiteness

of their blossoms. Many specimens, that we thought had reddened their blossoms, in certain reflections of light, almost imitated the tints of E. purpureum or E. maculatum. This does not seem extraordinary when we remember that along side of the Eupatoriums, by the margins of most of our roads, are many species of asters with tints varying from white and purple topped petals to every shade of blue and azure.

Report of the Botanical Division of the Biological Section.

HAMILTON ASSOCIATION,

FOR THE SUMMER OF 1889.

The mounting of the joint collections of Mr. Alexander, Mr. Walker, Mr. Morris and myself has been completed, and the specimens catalogued and deposited in the Society herbarium. The section is to be congratulated on the excellent showing made.

The number of specimens mounted was 219, of which 204 are species not before represented in our herbarium. This 204 species represents 28 additional orders and 118 additional genera.

The number of species new to the Hamilton Flora, as recorded by Logie and Buchan, is surprisingly large, being no less than 33, of which the following is a list:

Camelina sativa, Crantz.
Raphanus sativus, L.
Viola renifolia, Gr.
Cerastium nutans, Raf.
Lathyrus maritimus, Bigel.
Melilotus, alba, Lam.
Melilotus officinalis, Willd.
Trifolium hybridum, L.
Vicia sativa, L.
Potentilla pilosa, Willd.
Prunus, Pennsylvanica, L.
Sedum acre, L.
Epilobium palustre, var. lineare, Gr.
Lonicera glauca, Hill.
Lonicera Tartarica, L.
Symphoricarpus racemosus, var. pauciflorus, Robb.
Centaurea Cyanus, L.
Hieracium Gronovii, L.
Petasites palmata, Gr.
Tragopogon porrifolius, L.
Veronica Buxbaumii, Tenore.
Euphorbia Cyparissias, L.
Betula lutea, Mx. f.
Aplectrum hyemale, Nutt.
Asparagus officinalis, L.
Juncus Balticus, Delh.
Juncus nodosus, var. megacephalus, Torr.
Carex laxiflora, var. intermedia, Boott.
Carex pedunculata, Muhl.
Carex tenella, Schk.
Carex vaginata, Tausch.
Eliocharis tennuis, Schult.
Avena stiiata Mx.

T. J. W. BURGESS.

Report of the Conchological Division of the Biological Section.

HAMILTON ASSOCIATION.

LIST OF THE LAND AND FRESH WATER SHELLS OF THE HAMILTON DISTRICT TO THE END OF THE YEAR 1889.

BY A. W. HANHAM.

FAMILY LIMACIDÆ.

Some three species of slugs have been observed in this locality. They have yet to be examined and identified.

GENUS ZONITES, MONTFORD.

(*Section Mesomphix, Rafinesque*).

ZONITES FULIGINOSUS, *Griff.*

Generally distributed around Hamilton, found burrowing in moss and loose soil, also buried under decaying leaves; frequents banks; a difficult shell to find; must be considered one of our rarer species.

(*Section Hyalina, Fer.*)

ZONITES NITIDUS, *Müll.*

Common under logs and stones in damp places; very plentiful around Dundas marsh.

ZONITES ARBOREUS, *Say.*

Common, frequents old stumps and decaying wood.

ZONITES RADIATULUS, *Alder.*

Same situations as last, but not so widely distributed.

ZONITES INDENTATUS, *Say*.

Taken in moss and under bark on old stumps, sometimes on the ground; seldom more than two or three specimens found in same spot. Rare.

ZONITES MINUSCULUS, *Binney*.

Has been taken in but one locality around Hamilton, a ravine off the Flamboro' road; occurred there in great abundance, colonies of thirty or more being found under sticks, etc.

ZONITES EXIGUUS, *Stimpson*.

But three specimens taken, locality unknown.

(*Section Conulus, Fitzinger*).

ZONITES FULVUS, *Drap*.

Local; may be taken along the foot of the mountain under pieces of rotten wood in moist places; not abundant.

(*Section Gastrodonta, Albers.*)

ZONITES ———.

Rare; a few specimens taken; locality unknown; identification not complete.

FAMILY HELICIDÆ.

GENUS PATULA, HELD.

(*Section Anguispira, Morse.*)

PATULA ALTERNATA, *Say*.

A common shell; prefers moist situations; sometimes observed in colonies under logs.

(*Section Discus, Fitzinger.*)

PATULA PERSPECTIVA, *Say*.

Rare; a few taken along side of mountain under bark and logs.

PATULA STRIATELLA, *Anthony*.

Very plentiful throughout this district in woods and moist situations.

SUB-GENUS HELICODISCUS, MORSE.

PATULA LINEATA, *Say*.

Occurs in rotten wood; scarce.

GENUS PUNCTUM, MORSE.

PUNCTUM PYGMÆUM MINUTISSIMUM, *Lea.*

Our smallest shell; owing to minute size difficult to find, a few taken on the under side of a board in one of the ravines off the Flamboro' road.

GENUS HELIX, LINNE.

SUB-GENUS POLYGYRA, SAY.

(*Section Mesodon, Rafinesque*).

HELIX THYROIDES, *Say.*

Local; fond of shady hillsides.

HELIX ALBOLABRIS, *Say.*

A larger shell; more abundant, and also more widely distributed.

HELIX SAYII, *Binney.*

Very local; taken in some abundance in November under dead leaves on a steep bank formed by the railway intersecting one of the branches of the Waterdown ravine, confined to a very limited extent of ground.

(*Section Stenotrema, Raf.*)

HELIX MONODON, *Rack.*

Rare on dry banks.

HELIX MONODON FRATERNA, *Say.*

Common; prefers dry situations.

(*Section Triodopsis, Raf.*)

HELIX TRIDENTATA, *Sav.*

Common generally around Hamilton.

HELIX PALLIATA, *Say.*

Rare; may be found in sheltered spots under stones and logs on banks, and along side of mountain; appears to be solitary in its habits

(*Section Vallonia, Risso*).

HELIX PULCHELLA, *Müll.*

Plentiful under logs in damp meadows.

SUB-GENUS STROBILA, MORSE.

HELIX LABYRINTHICA, *Say.*

Rare; a few taken in a run in a small piece of open wood towards the Beach.

FAMILY PUPIDÆ.

GENUS PUPA, DRAP.

(*Section Pupilla, Leach*).

PUPA FALLAX, *Say*.

Common on dry bank of railway track towards Valley Inn.

PUPA CORTICARIA, *Say*.

Rare; occurs under bark on old stumps, and on the ground in moist places.

PUPA ARMIFERA, *Say*.

Very common; same locality as *Pupa fallax*.

PUPA CONTRACTA, *Say*.

Generally distributed throughout the district under logs, etc., in marshy spots.

SUB-GENUS ANGUSTULA, STERKI.

PUPA MILIUM, *Gould*.

Our smallest *Pupa*; a few taken in same locality as *Punctum pygmæum*.

GENUS VERTIGO, MULLER.

VERTIGO OVATA, *Say*.

A few large specimens taken at Lake Medad under logs; also found in company with *Pupa milium*.

VERTIGO VENTRICOSA, *Morse*.

One specimen taken with *Pupa milium*.

VERTIGO PENTODON, *Say*.

Under bark and in marshy situations; not common.

FAMILY STENOGYRIDÆ.

GENUS FERUSSACIA, RISSO.

SUB-GENUS CIONELLA, JEFFREYS.

FERUSSACIA SUBCYLINDRICA, *Linn*.

Common, fond of grassy railway banks.

FAMILY SUCCINEIDÆ.

GENUS SUCCINEA, DRAP.

SUCCINEA AVARA, *Say*.

A few taken near Dundas Marsh, and near stream through open woods.

SUCCINEA OBLIQUA, *Say*.

Common, moist spots on banks and in woods.

SUCCINEA OVALIS, *Gould*.

Common along edge of Dundas Marsh.

SUB-ORDER LIMNOPHILA.

FAMILY AURICULIDÆ.

GENUS CARYCHIUM, MULLER.

CARYCHIUM EXIGUUM, *Say*.

Common in decaying leaves, moss, and under sticks, etc., in swampy localities.

FAMILY LIMNÆIDÆ.

GENUS LIMNÆA, LAM.

SUB-GENUS LYMNOPHYSA, FITZ.

LIMNÆA STAGNALIS, *Linn*.

Common; Dundas Marsh.

LIMNÆA PALUSTRIS, *Müll*.

Common in streams and creeks around Bay and Marsh; very variable in size.

LIMNÆA HUMILIS, *Say*.

On rocks in streams; Chedoke Gorge and Dundas Ravine.

LIMNÆA DESIDIOSA, *Say*.

Not common; found in some streams around the city.

LIMNÆA CAPERATA, *Say*.

Common in some streams through open woods.

LIMNÆA GRACILIS.

Nearly 150 specimens taken Nov. 24 on Carroll's Point, thrown up in driftweed after a storm, not easily distinguished from the weed.

GENUS PHYSA, DRAP.

PHYSA GYRINA, *Say.*

Variable in size and color; may be found in streams, and generally around the bay.

PHYSA HETEROSTROPHA, *Say.*

Variable in size; same situations as *P. gyrina.*

GENUS BULINUS, ADAMSON.

BULINUS HYPNORUM, *Linn.*

A few very fine shells taken at Port Dover in a stagnant pond; may be found in some of the streams in woods; not so abundant as the two former species; is of very delicate structure. Ours are small as compared with those taken at Port Dover.

SUB-FAMILY PLANORBINÆ.

SUB-GENUS PLANORBELLA, HALDE.

PLANORBIS CAMPANULATUS, *Say.*

Common, Hamilton Bay and Dundas Marsh.

SUB-GENUS HELISOMA, SWAINSON.

PLANORBIS TRIVOLVIS, *Say.*

Variable in size and structure, common in the Bay.

PLANORBIS BICARINATUS, *Say.*

Hamilton Bay, not so plentiful as the two former species. Some specimens from near Ottawa are three times the size of any found here.

SUB-GENUS GYRAULUS, AGASSIZ.

PLANORBIS ALBUS, *Say.*

Two or three dead specimens from Dundas Marsh; a special search may prove it to be plentiful.

PLANORBIS DEFLECTUS, *Say.*

Dundas Marsh and Hamilton Bay.

PLANORBIS EXACUTUS, *Say.*

Dundas Marsh, and occurs sometimes in streams on decaying leaves.

PLANORBIS PARVUS, *Say.*

Common along shores of Bay and Marsh, and in some streams.

PLANORBIS NAUTILEUS.

Occurs in a small piece of marsh at the junction of Hamilton Bay and the Desjardines Canal. A very tiny shell, the smallest water shell known to me; is hairy. The Rev. G. W. Taylor in naming it states that it is identical with the English *P. nautileus*; from its small size is difficult to find; if an introduced shell it would be interesting to know by what agency it reached its present habitat; do not know that it has been taken anywhere else in North America.

SUB-GENUS PLANORBULA, HAIDE.

SEGMENTINA ARMIGERA. *Say.*

Has been taken in some abundance in the marsh toward Dundas, attached to dead leaves lying in the water.

SUB-FAMILY ANCYLINÆ.

GENUS ANCYLUS, GEOFFROY.

ANCYLUS RIVULARIS, *Say.*

Occurs in the Dundas Marsh and Hamilton Bay, a small colony found attached to sunken sticks in a small stagnant piece of water.

ORDER PECTINIBRANCHIATA.

FAMILY VALVATIDÆ.

GENUS VALVATA, MULL.

VALVATA TRICARINATA, *Say.*

Hamilton Bay, common.

VAVATA SINCERA, *Say.*

Hamilton Bay and Dundas Marsh, not so common as the last.

FAMILY VIVIPARIDÆ.

GENUS MELANTHO, *Bowditch.*

MELANTHO DECISUS, *Say.*

Hamilton Bay. Some very fine specimens taken from the Ancaster Creek, near its junction with the marsh. A few reversed specimens have been taken.

FAMILY RISSOIDÆ.

SUB-FAMILY HYDROBINÆ.

GENUS AMNICOLA.

AMNICOLA LIMOSA.

A few specimens from Dundas Marsh.

Two species of *Amnicola* not yet satisfactorily identified

SUB-FAMILY POMATIOPSINÆ.

GENUS POMATIOPSIS, TRYON.

POMATIOPSIS LAPIDARIA, *Say.*

Occurs in places around the marsh and in some of the ravines where damp ; is terrestrial in its habits.

FAMILY STREPOMATIDÆ, HALDE.

GENUS PLEUROCERA, RAF.

PLEUROCERA SUBULARE, *Lea.*

Common, Hamilton Bay.

GENUS GONIOBASIS, LEA.

GONIOBASIS LIVESCENS, *Menke.*

Common, Hamilton Bay.

ORDER CONCHIFERA.

FAMILY CYCLADIDÆ, WOODWARD.

GENUS SPHÆRIUM, SCOPOLI.

SPHÆRIUM SULCATUM, *Lam.*

Hamilton Bay, common.

SPHÆRIUM RHOMBOIDEUM, *Say.*

Hamilton Bay, rare.

SPHÆRIUM TRUNCATUM, *Linsley.*

Hamilton Bay, rare.

SPHÆRIUM PARTUMEIUM, *Say.*

Occurs in a stream towards the Beach. Some very fine specimens of this shell were taken in stagnant ponds in woods at Port Dover.

SPHÆRIUM STRAMINEUM.

Ancaster Creek, near marsh ; very plentiful.

SPHÆRIUM OCCIDENTALE, *Prime.*

Taken in Canal near Dundas ; also in streams running through open woods, among and under the dead leaves.

GENUS PISIDIUM, PF'R.

PISIDIUM ABDITUM, *Prime.*

Hamilton Bay and Dundas Marsh.

PISIDIUM COMPRESSUM, *Prime.*

Dundas Marsh ; only two or three specimens taken.

A THIRD SPECIES, as yet unnamed.

The *Sphæria* and *Pisidia* live in the mud in ditches, streams, etc. ; the latter from their small size are seldom noticed, or are mistaken for young shells.

FAMILY UNIONIDÆ.

SUB-GENUS UNIO, RETZIUS.

UNIO ALATUS, *Say.*

Occurs in the Bay ; a few large shells have been picked up on the shore between Willow and Carroll's Points.

UNIO GRACILIS, *Barnes.*

One very large specimen found on Carroll's Point.

UNIO GIBBOSUS, *Barnes.*

Have seen some valves supposed to have been picked up at the Beach ; is likely to occur there.

UNIO COMPLANATUS, *Sol.*

Very common ; Hamilton Bay.

UNIO NASUTUS, *Say.*

Occurs at Carroll's Point, and at other places around the Bay.

UNIO LUTEOLUS, *Lam.*

Very common around Hamilton Bay ; very variable in size, colour and markings ; some shells are very handsome.

UNIO SUBOVATUS, *Lea.*

A few dead shells have been taken near Carroll's Point belonging most likely to this species.

UNIO PRESSUS, *Lea.*

A few specimens from the Canal, near Dundas.

SUB-GENUS MARGARITANA, SCHUM.

MARGARITANA MARGINATA, *Say.*

A specimen of this shell was given to me as having been taken at the Beach.

SUB-GENUS ANODONTA, BRUG.

ANODONTA OVATA, *Lea.*

A few specimens from Dundas Marsh.

ANODONTA PLANA.

Carroll's Point, common.

ANODONTA BENEDICTII, *Lea.*

Common, same locality as last.

ANODONTA FLUVIATILIS, *Dillwyn.*

Occurs at Carroll's Point, and in some of the creeks running into the Bay.

Some *Anodons* from the Marsh, when determined, may add two or three species to this list.

THE HALF-YEARLY REPORT

OF THE

GEOLOGICAL SECTION

OF THE

HAMILTON ASSOCIATION,

ENDING APRIL 30TH, 1890.

HAMILTON, May 8th, 1890.

The Section, in submitting this report, is pleased to notice the active interest manifested in the work by the younger members. Although the members have not, as formerly, devoted so much of their time to the classifying, labelling and arranging of the large number of specimens now in the possession of the Section, for the reason that the specimens will require shortly to be moved to the more commodious apartments in the new Library building, which is now nearing completion, when a rearrangement will be necessary.

The members, however, have not been inactive meanwhile. Some, under the direction of our worthy chairman, Col. C. C. Grant, have been working on the Barton beds as well as giving daily attention to the various quarries under operation in the Niagara formation. The Barton beds are highly fossiliferous, presenting occasionally some new surprise, and what is always a source of gratification to collectors, the specimens found are usually in a good state of preservation. The various outcrops of rock in the vicinity of the city of Hamilton place the geological workers here in an enviable position. Dr. Spencer refers to it as the richest in fossil remains of all the districts he has ever met with, the number of graptolites collected from this district alone exceeds in variety and preservation the combined product of all other places in Canada. The upper beds of the Niagara supply us with many new forms of fossil sponges, which Prof. Head, of Chicago, says are peculiar to this district.

The Section is much indebted to the indefatigable exertions of our chairman, Col. C. C. Grant, for the many additions of new specimens made from time to time within the last year to the Palæontological museum; also for the papers given during the last six months.

The members of the Section have read several papers of geological interest, which have been the means of elucidating many points heretofore only partially understood.

The Section has held six meetings, the first on November 22nd, 1889, was devoted to the election of chairman and secretary, and other business in connection with the work of the Section. The second meeting was held December 27th, 1889, when Mr. A. E. Walker read a very interesting paper on the "Structure of Corals and Life of the Polyp." After referring briefly to the modern corals respecting their mode of growth and process of multiplication, forming colonies, which in turn form the well known reefs, barriers, etc. He then took up the Palæozoic corals, and from specimens showed that the process of petrifaction was owing to the presence of carbonates, sulphates, and silicates, and that their preservation up to the present time was in a more or less state of perfection, according to the nature of the permeating element. On January 24th, 1890, Mr. Henry Moore read a paper on the Niagara escarpment. He dealt more particularly with the outcrop at Niagara in an ascending order, begining with the Medina formation, giving the various thickness of the different strata, rock composition, and the fauna peculiar to each of the fossiliferous deposits.

Februray 28th Col. C. C. Grant read a paper, being the first of a series of geological notes entitled:

NOTES ON "BEATRICEA"—(BILLINGS.)

A NIAGARA AND CAMBRO-SILURIAN FOSSIL OF ANTICOSTI.

Perhaps no fossil (Eozoon Canadense excepted) has led to a greater difference of opinion among Palæontologists than the very remarkable one I have selected as the subject of a few brief remarks on the present occasion,—The "Beatricea of the late Mr. Billings.

Its classification still remains a matter of dispute. The tree-like appearance presented first led to its being considered a plant, but when sections were prepared for microscopical examination that

idea was found untenable, and Billings came to the conclusion it represented an extinct order of corals. Other Palæontologists suggested the possibility of an alliance with the gigantic "Sessonias" found on the rocky coasts of the Faulkland Islands near the Strait of Magellan. Their growth resembles that of a tree; the stem is about ten feet long and as thick as a man's thigh, terminating in a crown of leaves from two to three feet long.

Others, again, expressed their opinion that it was related to the modern "Macrocystes," detached by storms off Tierra del Fuego, and described by Professor Meyen, who remarks: "By the exertions of five men we succeeded in hauling the enormous mass on board. It was impossible to disentangle it; we could only detach some sixty feet of what we considered to be the main stem. We estimated the plant at or about two hundred feet in length. A Toronto professor who examined a few specimens of Beatrecea I brought from Anticosti considered it an extinct Fucoid, adding 'It is by no means unusual to find the Colossal Algæ of the Pacific hollow in the interior.' It was more recently put down as a gigantic Stromatopora by an American friend of mine who examined prepared sections under the microscope. I doubt if Mr. Walker would feel disposed to recognize it as a member of that family."

Finally, Professor Hyatt, of Harvard University, asserted the Beatricea were the internal bones of Cephalopods. From his (Hyatt's) observations, "it seems probable," remarks Dana, "they are like straight branches of a tree, with irregularly fluted or uneven exterior, and have been described as plants; they possess 'a cone' in cone structure, with cellular interspaces about the centre, the plates in contact towards the sides." About five or six miles north of Fox Bay, on the east side, an unbroken perpendicular cliff presents itself, extending for a distance of seventeen miles. (This was a portion of the coast unexplored by Richardson owing to stormy weather). When the sea is perfectly calm you can land on a narrow strip of sand as the base, varying from a few yards to twenty paces broad. I had the good fortune to enjoy exceptionally fine weather during that portion of my trip around Anticosti, and travelled almost the entire distance on foot, and it was there I first saw this extraordinary fossil in situ.

The description given by Richardson respecting its appearance projecting from "the cliff" in tiers at "Battery Point" is also appli-

cable along the entire way almost to Salmon River, but at this locality the cliff is low—about sixty feet, and the fossils are more accessible and readily obtained. They are exceedingly brittle and difficult to extract, even though the matrix here is more shaly than in other places. *In not a single instance was Beatricea found erect*, although hundreds were seen, whereas the associated Corals and Stromatopora were frequently found fossilized as they grew, and entombed in the sediment which had gathered around them.

I recollect only two instances where the base of the fossil was displayed. I succeeded in getting one all right; the other was badly fractured. It resembles a Mesozoic Belemnite in outward appearance. The base is so slight that I felt convinced it could never have supported Beatricea in an erect position. When I returned from Anticosti I pointed out to Mr. Whiteaves that I thought my old friend Mr. Billings was mistaken in considering it a "coral," and that its proper classification would be among the "Cuttle-fishes." Mr. Whiteaves, in reply, mentioned he had received a communication from Professor Hyatt two years before to the same effect, and on examining the revised edition of Dana's Manual, I found a paragraph regarding the fossil previously unnoticed.

I made a close examination of the Niagara beds at Gamache, or Ellis's Bay, where Richardson found a Beatrecea 10½ feet long, 6 inches in diameter at larger end and 5 inches at the other, but I failed to discover there or elsewhere specimens of the size given in the Geology of Canada. The largest I saw was under 6 feet, but I was informed that a few years before I arrived, a party of American gentlemen from Boston had landed near Salmon River and carried off a fossil "as long as a boat-hook."

Probably some of the section may not have seen an account of a modern Cuttle-fish which had gone ashore in 1876 at Newfoundland. The Rev. Moses Harvey, a well-known naturalist (who recently discovered seals, young and old, living in inland fresh water lakes in the island, many miles from the sea), made a careful examination of this "great devil fish," erroneously so styled. The measurements were as follows: Of the ten arms the two long ones measured 30 feet in length, 5 inches in circumference at the thinner portion, 8 inches at the broad end; the short arms were 11 feet long and 17 inches in circumference; the body was 9 feet 6 inches; the

head 4 feet in circumference; the diameter of the eyeball 8 inches; the flap of the tail measured 2 feet 9 inches across. Another giant Squid was described by Professor Verrill in the *American Naturalist* in 1875 from the same locality. Surely in the face of such well authenticated facts it is rather amusing to read the following remarks of the author of "The Sea and Its Living Wonders," Dr. Hartwig, of Gottengen, whose work has been translated into many languages:

"According to trustworthy testimonies, some species of Cephalopods attain an astonishing size. Peron saw a Sepia near Van Dieman's Land with arms like snakes, 7 feet long. But not satisfied with reality, some writers have magnified the cuttle-fishes to fabulous dimensions. Pliny notices one monster with arms 30 feet long." Well, considering all we have recently learned from the Rev. M. Harvey and others, perhaps the elder Pliny was not so unreliable a naturalist after all as some suppose. It does not appear incredible that cuttle-fishes, when the family and its allies were "Lords of Creation," may have attained an extraordinary size. As far as we know they had nothing to contend against when the "Hudson River" beds were deposited. During the earlier ages of geological history, they appear to have been the magnates of the sea. Geikie remarks, "An Orthoceras, from 8 to 10 feet in length has been discovered in the Bala beds" (our Hudson River rocks). Professor Chapman, of Toronto, pointed out to me a fragment of one he discovered—now in one of the cases of the "University Museum"—comparable in thickness with any Beatrecea (one or two excepted) I met with in Anticosti.

Some years ago, I showed Dr. Spencer, in a quarry at the "Jolly Cut," an Orthoceras which covered the surface of four large limestone flags. On one of them I counted 65 Septa.

In conclusion, while I entertain precisely the same views as Professor Hyatt regarding the fossil, it is only fair to remark that very little is known yet of the Silurian Plant remains, and the Fucoids themselves present no internal structure. The Palæophycus of Hall, and two or more undescribed ones in the Clinton rocks of Hamilton, Ontario, undoubtedly possess a conical root, not unlike the base of a Beatrecea.

Through the kindness of my friend, Mr. Walker, I am enabled to submit for your examination two polished specimens (longitudinal and transverse sections) of the fossil. As far as I know, the

late Mr. Billings described only *two* species from Anticosti, whereas I noticed *four* there. One, however, by some Palæontologists, may be considered a variety only. The other is undescribed as yet. The external surface is covered by what at first seems a "Bryozoon." Possibly this may be only a deceptive appearance, and it may prove to be an outer portion. An epitheca, as it were, of the fossil.

March 28th, 1890, Col. C. C. Grant read a paper on the color of Shells, stating that a short time ago, in a paper on "Silurian Colored Lingula of Hamilton" he had ventured to express a doubt as to the usually accepted belief that the color of shells was solely owing to the action of light, but may possibly be partly due to other causes as well. His views were endorsed by Prof. Agassiz, who accompanied the little band of scientists in a recent American scientific expedition on board the steamer Blake, who observed that the Abyssal Shells possessed the predominant tints, viz: White, Pink, Red, Scarlet, Orange, Yellow, Violet, Purple, Green and allied colors. In deep water types the variety among them of coloring is quite as striking as that of better known marine animals. There is as great diversity of color in the deep water Star fishes as there is in those of our rocky or sandy shores. The Actinae (Sea Anemone) of deep water possesses stripes and tints as abundantly as the more common ones in shallow water. The Genus Trochidae are largely represented in Abyssal regions, brilliantly colored and pearly spiral shells. Marginella, Mitra, Typhis, Cancellaria, etc., have also been found at considerable depths.

On the same evening the secretary read a paper from Prof. D. F. H. Wilkins, B. A., of Beamsville, entitled, "Borings for Gas," and the occurrence of impure salt in the Medina group. The first part of the paper dealt with the various rock strata passed through in sinking two wells in the neighborhood of St. Catharines, one to a depth of 1,582 feet, the second to 2,450 feet; both wells were abandoned. The second part of the paper treats upon the saline nature of the Medina rocks. The presence of these calcium and magnesium chlorides, which are so frequently met with in the boring of wells for water in the Medina clays, suggests that their presence is due to the sudden precipitation of rock matter in the turbid ocean. We shall not fail to see that it is altogether likely that some of the waters of the ancient sea would impregnate at least some of the strata. May not this withdrawal have been much

greater than has been hitherto imagined, and may not this go towards accounting for the fact that the salt of the Onondago group is so free from foreign matter? The writer, in saying this, knows that the presence of such quantities of dolomite as the Niagara, Guelph and Onondago groups present, represent also the withdrawal of large quantities of the bitter chlorides, as calcium and magnesium carbonates leaving sodium chloride disolved in the ocean. Still it is far from improbable that the red shales and sandstones of the Medina and Clinton groups may have carried down with them a large mass of the bitter, burning, tasting salts above mentioned. The chemist knows how barium sulphate, when precipitated from copper or iron sulphate solution, is apt to carry copper or iron with it, and many other like instances could be given. Why then may not an immense mass of red clay or sand in a turbid ocean, showing by its color the absence of organic life and rapid deposition? why may not this have carried down matter which, under other conditions, is not merely soluble but absolutely deliquiscent?

April 25th, 1890, Col. C. C. Grant read a paper entitled, "Is the Deluge a Myth?" He took the ground that from geological evidence it was impossible to accept the universality of the Deluge. The fact of finding coral shells on lofty eminences did not prove that their presence there was due to the so-called deluge covering those eminences. It was his opinion that the mythical deluge is to be looked for in the glacial period, when the great ice sheet was receeding—the period of the formation of vast inland lakes, and immense floods, covered by the melting ice, of the great and local glaciers—a period, too, of continental depression.

COL. C. C. GRANT,
Chairman.

A. T. NEILL,
Secretary.

RIVER VALLEYS OF THE NIAGARA ESCARPMENT.

BY D. F. H. WILKINS, B. A., BAC. APP. SCI., HEAD MASTER,
HIGH SCHOOL, BEAMSVILLE, ONT.

Read before the Hamilton Association, May 8th, 1890.

That salient feature of the landscape of Western Ontario known as the Niagara escarpment, in its course through the counties of Lincoln, Wentworth, Halton, Wellington, Dufferin, Simcoe, Grey, and Bruce, as well as on through the Manitoulin islands, possesses among other interesting characteristics, a large number of river valleys of all sorts and sizes. Some are recent; others, ancient: some tell the story of repeated submergence beneath the waves; others, again, are almost of yesterday. Some have gently sloping sides; others with their precipitous, picturesque, angular walls, resemble in miniature the canyons of the far West. In some the drainage of the upland is slowly but surely carving its way to the plain below; in others, the dried-up stream-bed and the bare rock-ledges speak of diminished rain-fall and of complete erosion. In some a jungle of tree and shrub clothes the entire glen; in others, the traveller pushes onward amongst grass and herbs only.

Of the valleys, the most important to the north is certainly that of the Sydenham, in Grey county; for a glance at the map shows that it, in former days, carved out that large and beautiful and now valuable expanse of water known as Owen Sound. There we find that the present unimportant stream, after winding on gently through field and forest, plunges down two or three picturesque falls, and flows onward through a flood-plain, its former valley, of which more anon. Moreover, the stream has excavated, after the manner of Niagara, a deep and narrow gorge in the limestone, the ledges of which have caused the cascades just referred to; and that this erosion is very recent, will be apparent to all who carefully study the district. The ancient valley just mentioned deserves here a little longer notice. Its breadth increases from a few hundred feet at the south end to over a mile at the present river-mouth, and it extends further as we go northward to a width of three miles. Its length,

as far as has been traced, is nine miles, six of which are under the water of the Georgian Bay, and three covered by the thriving, enterprising city of the north, Owen Sound. Its depth is very uneven. In some parts, not the deepest, the Niagara limestone is met with at the surface; in others rock is not reached until a depth of thirty or forty feet has been gained. The valley, too, has been filled with blue clay, brown clay, sand and gravel, by no means in regular sequence, often stratified, and all capped with a series of terraces, which reach the higher ground. However, to the writer's knowledge, no minute survey of the valley has been hitherto attempted; and it may be that if this were done, some of the facts above stated might be given more in detail. While, therefore, it were unsafe to speculate further, it may be stated that at present the region seems to indicate a former area of high elevation, and drainage by means of a river, the course of which greatly resembles that of the modern Sydenham, but the volume of which was vastly greater.

Apologising for digressing upon ancient river beds, let us take our journey southward, following the escarpment. Here a series of picturesque ravines and valleys meets us, some of which are due to water erosion, and the others to the action of sub-ærial causes upon the joints and fissures of the limestone. Referring particularly to the latter, it may be stated that large cracks and dangerous crevices have resulted, here separating areas of rock which sometimes exceed an acre, there tumbling down mass after mass of stone and boulder in inextricable confusion; in many cases too these crevices have in course of time become interesting ravines, steep-walled and moss-clad. Still, none of these rise to the dignity of true valleys, nor in fact does any one until we reach the Beaver river, which, plunging down a precipice of seventy-five feet at the Eugenia Falls, Artemesia Township, Grey County, has excavated for itself a beautiful fertile dale. The breadth of this valley is at its widest over three miles, and the length about eight. This valley, so far as examined, which examination has been but superficially done, appears quite modern in geological time. So far as known, the deposits upon its flood-plain are quite recent, and evidently have been derived from the highland above.

Traversing the highland in a general westerly direction at a distance of some twenty miles west from the above, and from ten to thirty miles south of the Sydenham, are the beautiful valleys of the

five or six streams of the Saugeen river. Of these one, the central or Big Saugeen, deserves especial notice, for its valley in some places exceeds a mile and-a-half to two miles in width and over a hundred feet in depth, its banks being ridges of stratified gravel. Here and there in its bed the rock reaches the surface; but while exposures are abundant on the more northern tributaries that flow through Durham and the Rocky Saugeen further north, as a rule these rock exposures are absent from the main stream, until Ayton is reached in Grey County and Walkerton in the adjacent County of Bruce. The valley of the branch in which Durham is situated is in like manner over two miles in width from mouth to mouth, and in depth over a hundred feet.

Returning to the escarpment's edge, the next valley of importance is that of the Credit in Caledon Township. This presents a great resemblance to the valley known as Glen Spencer, Dundas, but exceeds this both in breadth and depth. It is evidently a valley of erosion, the Credit having cut its way down through three hundred feet to the lower beds of the Medina rock, and in so doing formed a romantic fir and pine-clad glen of half a mile to a mile in width. From the fact that the superficial deposits seem, so far as noticed, to occur only sparingly, it would seem that in the Credit we have an ancient river, re-cutting its bed to a lower level.

The Grand River, with its tributaries, the Irvine, the Speed, and the Canestoga, presents picturesque valleys, especially the canyon of the Irvine at Elora, north of Guelph. There the river Irvine has excavated a narrow gorge to the depth of nearly a hundred feet in Guelph limestone, and from the fact that no recent deposits are found on the sides, one may infer that the gorge is of modern formation. Other picturesque valleys occur at various points along the line of the main stream, especially at Galt, where the ancient river-valley is plainly visible, and where the present diminished stream wanders through flats of its own making.

Again, coming eastward to the edge of the escarpment, the valleys of the Twelve and Sixteen Mile Creeks of Halton county are worthy of a brief notice. Deep and wide glens, wooded to their tops, visible from a long distance, both of lake and of land, break the uneven outline of the summit. Like the Sydenham, the Beaver and the Credit, too, the streams wander on through deep gorges cut far into the plains; that of the Sixteen Mile Creek being remarkable

for showing near its mouth at Oakville, the Loraine (or Lorraine) shales of the Hudson river group on the eastern side, and on the western, the red Medina shales and sandstones. Moreover, in the Twelve Mile Creek valley near Bronte Station, extends a bed of stratified gravel, now eroded, showing clearly the ancient character of the stream. This bed of gravel is about seventy-five feet thick, and is made up largely of Hudson River fragments.

Of similar formation are the gorges of the "Grindstone Creek," Waterdown, and "Glen Spencer," at Dundas—glens with steep, wooded sides, the former almost straight in its course, the latter much curved; glens carrying moreover upon these sides strips of stratified sand and gravel; glens of great breadth and depth.

Turning the escarpment at or east of Copetown, and continuing along the ridge to Niagara, we encounter a series of creeks, some larger, some smaller, which have cut their way down through Niagara, Clinton and Medina rock, and of course, through those overlying deposits known as the ancient Lake Beaches. They are known as the Albion Mills Creek, the Fifty, Forty, Thirty, Twenty, Sixteen, Fifteen and Eight Mile Creeks respectively. To these we must add sundry dried up torrent beds, which present similar features to the creeks; and these features are like those above referred to, namely—glens or canyons of large or of small size, cut into the rock, and winding, straight-walled valleys in the plain. From the sediment brought down by the Albion Mills Creek, Burlington Beach has been made; and at the mouth of each of the others, bars are being built of larger or of smaller volume, according to the usual conditions of more or less material, and the set of the Lake currents. Like the other creeks on the north side of the escarpment, too, the present streams exist in vastly diminished volume. Picturesque waterfalls, moreover, are another feature well marked in the still existing streams, while, in the dried-up water-courses, their action can be plainly noticed.

The canyon of Niagara, so well-known to all, and yet so sublime in its magnificent, ocean-like rapids, and its majestic sweep of water down the steep cliffs, should detain us for a moment. For here, before our eyes, we see the work of erosion and excavation going on; here we have the key to our lesser river-valleys, those excepted which have resulted from the slow-weathering of former joints and fissures. We must remember, too, that Niagara is, after all, a very

recent river; we must not forget the Post-Pliocene beds of Goat Island and of the river banks, through which this deep and dark stream has cut its way; we must not forget the former, now drift-filled, outlet from the present whirlpool to St. David's village.

But chiefly this magnificent mass of thundering water should recall to us the formation of, so far as known, the ancient valley of the escarpment, the valley at Hamilton. A valley diminishing in width from eight miles to one, and traceable, as has been most ably shown by Dr. J. W. Spencer, Director of the Geological Survey, Georgia, as far as Caledonia, thence southeastwardly to Lake Erie, thence across the present lake to Pennsylvania and to Western Virginia—such a valley as this makes Niagara dwindle into insignificance. What a landscape, too, of boiling rapids, tumultuous surges, mountain-like waves and noble falls this must have presented—a glorious spectacle, upon which no human eye ever gazed! Nor did the work of the waters end there, as the slopes and terraces at the bottom of Lake Ontario to-day bear witness. Yet this channel from Hamilton to Lake Erie is choked with drift, so that its very existence lay unknown till about ten years ago; upon the sand and the clay filling the channel, farming has been carried on for well nigh a century, and still goes on to-day.

With this scanty description of the valleys of the Niagara ridge, let us ascend to the summit, tracing these streams to their source; and in order to be more exact, let us consider the last described series of creeks first in order. Now when we ascend to the highland, we notice one or two features of importance; and of these the first is that the highest part of the escarpment is, in general, at or near the edge, that there is a general southwesterly slope, not exactly the same as the dip of the strata. Thus, while Queenston Heights is three hundred and sixty-seven feet above Lake Ontario, Buffalo, on Lake Erie, is but three hundred and twenty-seven feet; on the Welland railway, in like manner, there is a southerly slope of fifteen feet in the distance between Thorold and Port Colborne, and the brow of the escarpment at Hamilton is seventy-eight feet above Port Dover. True, in the last case, the "Summit," a short distance south of the escarpment, about five miles say, is about a hundred feet higher, and true it is that, between Jarvis and Hagersville, we have a slightly lower ridge; yet this does not lessen the value of the general statement, especially if we remember that the former-men-

tioned ridge is the summit of the Niagara limestone, and the latter a recent deposit of clay and sand. On the whole, it is perfectly safe to reckon a fall towards Lake Erie of fifty feet in twenty-five miles, or two feet to the mile southward, while the dip of the Niagara group is uniformly twenty-two feet to the mile. Moreover, throughout the greater part of this area, the underlying rock is conspicuous by absence, a few places near Buffalo, one near Hagersville, and one or two on the Grand River, affording the only known outcrops of Onondaga, Oriskany or Corniferous groups. This certainly points to an increase of sediment to the southward, as well as to an uplift making the escarpment the northern margin of the area now covered by South Lincoln, Welland, Monck, South Wentworth, and Haldimand counties, omitting for the present, counties lying further west. A second feature of interest is that ridges of clay or of sand cross this area from east to west or nearly so, between which lie stretches of marsh or swamp, in which these creeks take their rise, together with sundry other creeks now flowing southward. These marshy areas and sand and clay ridges point to a former northward extension of Lake Erie, of which, as has been already stated, the edge of the escarpment was the northern boundary. A third point of interest is that in no part of this area does the land rise higher than five hundred feet above Lake Ontario. The creeks referred to then, rise in a marshy area, cut off by sand and clay ridges from Lake Erie, and they have been thus compelled to take a northerly direction.

If we now similarly trace the creek running through Glen Spencer, and the Grindstone Creek, back to the summit, we shall find their sources in an immense rocky and stony swamp, known as the "Beverly Swamp," in which also rises Fairchild's Creek, flowing southwesterly through the extreme west of Wentworth and through North Brant to the Grand River. Moreover, the Twelve and the Sixteen Mile Creeks of Halton County may be traced to this same source. In this area, covering North Wentworth, part of Halton, part of Waterloo, and a small piece of South Wellington Counties, we find the same well-marked features as in the preceding, namely, the highest part of the surface at or near the the summit of the escarpment, and the slope greater than that of the strata; also a swampy area, diversified by ridges of stratified gravel, some stretching east and west, others north and south. As a contrast, however,

we have several lakelets remaining, although rapidly silting up; of these it is necessary only to mention Lake Medad, near Waterdown, and Puslinch Lake, east of Hespeler. Again, too, by way of contrast, this district attains an altitude varying from over five hundred feet to over seven hundred above Lake Ontario, thus showing us another more ancient extension of the present Lakes Erie and Huron.

Tracing the rivers of the first, the most northerly mentioned district to their sources, we find in the counties of Simcoe, Grey, Dufferin, North Wellington, North Perth and Bruce, the largest and most important area of all, possessing the same general characteristics—the highest part nearest the front of the escarpment, and a slope thence westward and northward; beautiful lakelets, bilberry and tamarack swamps, broken by ridges of stratified gravel, and fine, clear streams of pure water. Often the gravel ridges guide the course of the streams, suggesting as has been already remarked in the case of the Saugeen branches, a deep valley of erosion, a view dispelled by a more thorough examination. Often, too, where the land has been cleared and drained giving a fertile tract to the farmer, the view from one of these ridges is entrancing indeed. The cleared plain, through which the stream meanders, rolls away to the next distant ridge mayhap three, mayhap ten miles; here is a strip of uncleared swamp-land, the home of the Linnea borealis and of the pitcher-plant, and the haunt of the white-throated sparrow and of the blue jay; there is one of the many charming, tree-embowered lakelets that dot the landscape of this northern area. Here as before we see the extension still further of the present great lakes, or rather in the great lakes we see the remnant of a once great fresh-water sea which covered the whole western peninsula of Ontario. Now, bearing in mind that the last described area has a mean elevation of eleven hundred feet above Lake Ontario, and that the proof of this having been once submerged is evident, let us state the full significance of this and briefly recapitulate the steps by which our river-valleys, so imperfectly described above, have originated.

A submergence which would place the summit of our western peninsula, Dundalk, Grey Co., seventeen hundred feet above the level of the sea, beneath the waves, would cover not only the whole of Ontario as far as the "Height of Land," or the Laurentides north of the Ottawa, but would submerge all Quebec except the monntains

of the eastern townships, the Gaspe peninsula and the north shore. The lower-lying parts of Vermont, the whole of middle and western New York, northern Pennyslvania, a great part of Ohio, Indiana, Missouri and Michigan, leaving out other more remote provinces and states, would be buried under the waters of a lake whose probable boundaries would be the Laurentides on the north, the Adirondacks, and including Lake Champlain, the Green Mountains on the east, the Catskills and other Appalachion chains on the south-east, certain north-facing escarpments in Ohio and Indiana to the north, and certain other escarpments of Wisconsin on the west. That such a submergence did take place has been ably shown by the researches of Dr. Spencer, who has placed the existence of the resulting lake beyond a doubt, and has named it in honor of the famous American geologist, Lake Warren. By a succession of differential uplifts to the north and the east, the three areas of Western Ontario mentioned in the preceeding paragraphs were up-heaved, leaving us when the St. Lawrence was lowered to its present level, our lake system as we understand it to-day. The movement of uplift was probably slow and gradual since we pass almost imperecptibly from area to area. Such area, too, is not of uniform level, the first varying from nine hundred to fourteen hundred feet in height above Lake Ontario, the second from five hundred to eight hundred, the third from three hundred and twenty to five hundred. As each area was separated from the great lake it became a subordinate sheet of fresh water ponded back by gravel ridges and by the escarpment; a body of water from which issued in greater volume than at present the streams which have carved out the river-valleys above described. As time went on the silting up of these bodies of water caused the formation of marshes and swamps, and the isolation of the lakelets before mentioned; in other words, each became in turn from a noble sheet of water, a tract of bog and swamp, with lakelets dotting the surface here and there. Finally, man appeared on the scene, and by stripping the country of forest and draining the land, reduced the volume of the streams to their present size.

There remain two questions to be answered. The first is that since the escarpment front offers the highest barrier to these swamps, why the creeks described have forced their way through the rock, rather than through the gravel ridges. The answer to this is

that the escarpment face is not an artificially-made, uniform wall, but a natural slope of more or less strength, thickness, hardness, etc., and therefore more susceptible to weathering in some parts than in others. It will be found, on examination, that the streams have invariably broken through weaker parts of their boundary, especially where they are traversed by faults, joints, etc. The second is the date, geologically speaking, at which this inland fresh water sea existed, from which the present system was evolved. With the small amount of information that we at present have, and in the present imperfect state of our knowledge of recent formations, we can only state definitely the later Post-Pliocene as the period when, by the series of uplifts, this lake was formed, and by the help of more of these. it was finally dismembered and drained.

HAMILTON ASSOCIATION.

Statement of Receipts and Disbursements for the Year ending May 1st, 1890.

INCOME.

Balance as per last report	$163 49
Government Grant	400 00
Subscriptions	120 00
Sale of Books	49 75
Interest	2 50
	$735 74

EXPENSES.

Books, Stationery, Printing and Advertising	$177 20
Postage, Express, &c	25 80
Gas	13 40
Rent	200 00
Insurance	12 50
Furniture, &c	20 10
Caretaker	10 00
Balance	276 74
	$735 74

RICHARD BULL,
Treasurer.

Audited and found correct.

A. T. NEILL,
Auditor.

May 7th, 1890.

OPENING OF OUR NEW PREMISES.

September 14th, 1890.

As intimated in the Report of the Council presented to the Association at the annual meeting held in May last, we have taken possession of our new room in the Public Library Building.

The specimens in the museum have all been removed and re-arranged in the cases in their new quarters.

The room is a great improvement on the one we have left. The location is better, and the room more commodious and airy, and it is better lighted.

The Association is much indebted to the Curator, Mr. A. Gaviller, Mr. A. E. Walker and Colonel Grant, who did the most of the work of packing up and re-arranging the specimens.

The room was formally opened on the same day as the Art School and the Free Library were inaugurated. On that occasion the Earl and Countess of Aberdeen, Sir Daniel Wilson, of the Toronto University, the Hon. G. W. Ross, Minister of Education, and others visited the room, and were received by the members of the Council and their wives.

At the subsequent meeting in the Library his Lordship, as well as our President, Mr. B. E. Charlton, advocated the claims of our Association before the citizens assembled. Setting forth at length its advantages in giving an impetus and aid to literary and scientific studies.

The prospects for the future of our Association are brighter than they have been for many years, though we have had several losses by removal of valuable active members whose places will be very difficult to fill.

Already many applications for membership have been received, and it is hoped that the members of the Association will do their best to bring the claims and advantages of the Association before their friends, and induce as many as possible of those who will take an active interest in its welfare to join us. For that purpose the Secretary or any member of the Council will be glad to supply "Forms of Application."

The first general meeting of the Association for the Session of 1890-91 will be held on Thursday. November 13th, 1890.

The Biological Section meets on the first and third Fridays of each month, and the Geological Section on the fourth Friday.

It is in contemplation to form a Philological Section, the time of meeting not yet fixed.

These Sections are open to all the members of the Association, and it is hoped that with the increased comfort of our meeting place there will be a more general interest taken in Section work.

A. ALEXANDER,
Secretary.

B. E. CHARLTON,
President.

HAMILTON, Nov. 10th, 1890.

ERRATA

FOR MR. MOFFAT'S PAPER ON "THE QUESTION OF THE VARIATION OF SPECIES."

Page 21, line 8 from top—for *on* the species read *of.*
" 22, " 7 " bottom—for *rectifying* read *modifying.*
" 25, " 3 " " —omit *have.*
" 25, " 1 " " —for *alone* read *alive.*
" 26, " 2 " " —for *ridiculous* read *pediculous.*
" 26, " 1 " " —for *existed* read *exist.*
" 28, " 16 " top—after some insert *means.*
" 28, " 11 " bottom—for *standing* read *steadily.*
" 29, " 16 " top—for *begets* read *by its.*
" 29, " 2 " bottom—for *naming* read *examining.*
" 30, " 1 " top—for *and* read *an.*
" 30, " 7 " " —for *sight* read *slight.*
" 30, " 10 " " —for *get* read *be yet.*
" 31, " 13 " bottom—for *effecting* read *expecting.*
The last line should be in quotation marks.

JOURNAL AND PROCEEDINGS

10,307.

—OF THE—

Hamilton Association

FOR SESSION 1890-91.

PART VII.

CONTENTS.

AUTHORS OF PAPERS ARE ALONE RESPONSIBLE FOR STATEMENTS MADE AND OPINIONS EXPRESSED THEREIN.

PRINTED FOR THE HAMILTON ASSOCIATION BY THE TIMES PRINTING COMPANY.

1891.

JOURNAL AND PROCEEDINGS

—OF THE—

Hamilton Association

FOR SESSION 1890-91.

PART VII.

AUTHORS OF PAPERS ARE ALONE RESPONSIBLE FOR STATEMENTS MADE AND OPINIONS EXPRESSED THEREIN.

PRINTED FOR THE HAMILTON ASSOCIATION BY THE TIMES PRINTING COMPANY.

1891.

OFFICERS FOR 1890-91.

President.

B. E. CHARLTON, Esq.

Vice-Presidents.

J. ALSTON MOFFAT. A. T. NEILL.

Secretaries.

H. B. WITTON, B. A. A. ALEXANDER, F. S. Sc., Lon., Eng.

Treasurer.

RICHARD BULL.

Curator and Librarian.

ALEXANDER GAVILLER.

Council.

COLONEL GRANT. W. A. ROBINSON. A. E. WALKER.
THOMAS MORRIS, Jr. A. W. HANHAM.

Museum and Library.

NEW PUBLIC FREE LIBRARY BUILDING,

Main Street West, near James.

OFFICE

	President.	1st Vice-Pres.	2nd Vice-Pres.
1857	Rev. W. Ormiston, D. D.	John Rae, M. D., F. R. G. S.	J. B. Hurlburt, M.A., LL. D.
1858	John Rae, M. D., F. R. G. S.	Rev. W. Ormiston, D. D.	J. B. Hurlburt, M.A., LL. D.
1859	Rev. W. Ormiston, D. D.	J. B. Hurlburt, M.A., LL. D.	Chas. Robb........
1860	Rev. W. Inglis, D. D.	T. McIlwraith......	Rev. W. Ormiston, D. D.
1861	Rev. W. Ormiston, D. D.	J. B. Hurlburt, M A., LL. D.	Rev. W. Inglis, D. D.
1871	W. Proudfoot	Judge Logie	R. Bull............
1872	Judge Logie......	H. B. Witton, M.P..	R. Bull............
1873	H. B. Witton, M.P.	J. M. Buchan, M. A.	A. T. Freed.. ....
1874	H. B. Witton, M.P.	J. M. Buchan, M. A.	A. T. Freed.......
1875	H. B. Witton.....	J. M. Buchan, M. A.	W. H. Mills........
1880	T. McIlwraith	Rev. W. P. Wright, M. A.	H. B. Witton.......
1881	J. D. Macdonald, M. D.	R. B. Hare, Ph. D..	B. E. Charlton .....
1882	J. D. Macdonald, M. D.	B. E. Charlton	J. A. Mullin, M. D..
1883	J. D. Macdonald, M. D.	B. E. Charlton	H. B. Witton ....
1884	J. D. Macdonald, M. D.	H. B. Witton......	Rev. C. H. Mockridge, M.A., D.D.
1885	Rev. C. H. Mockridge, M.A., D.D.	Rev. S. Lyle.......	W. Kennedy........
1886	Rev. C. H. Mockridge, M.A., D.D.	Rev. S. Lyle.......	Matthew Leggat....
1887	Rev. S. Lyle, B. D.	B. E. Charlton	W. A. Child, M. A..
1888	Rev. S. Lyle, B. D.	T. J. W. Burgess, M.B., F. R. S. C.	W. A. Child, M. A..
1889	B. E. Charlton ...	T. J. W. Burgess, M.B., F. R. S. C.	J. Alston Moffat....
1890	B. E. Charlton ...	J. Alston Moffat....	A. T. Neill........
1891	B. E. Charlton...	A. T. Neill........	S. Briggs..........

BEARERS.

Cor. Sec.	Rec. Sec.	Treas	Libr. and Cur.
T. C. Keefer, C. E.	Dr. Craigie	W. H. Park ...	A. Harvey.
T. C. Keefer, C. E.	Dr. Craigie	W. H. Park ...	A. Harvey.
T. C. Keefer, C. E.	Dr. Craigie	W. H. Park ...	A. Harvey.
Dr. Craigie.....	Wm. Craigie....	W. H. Park ...	Chas. Robb.
Dr. Craigie.....	Wm. Craigie....	W. H. Park ...	T. McIlwraith.
J. M. Buchan, M. A.	I. B. McQuesten, M. A.	W. G. Crawford	T. McIlwraith.
J. M. Buchan, M. A.	I. B. McQuesten, M. A.	W. G. Crawford	T. McIlwraith.
Geo Dickson, M. A.	Geo. Dickson, M. A.	R. Bull........	T. McIlwraith.
Geo. Dickson, M. A.	Geo. Dickson, M. A.	R. Bull........	T. McIlwraith.
Geo. Dickson, M. A.	Geo. Dickson, M. A.	A. Macallum, M. A.	T. McIlwraith.
R. B. Hare, Ph. D.	Geo. Dickson, M. A.	R. Bull........	A. T. Freed.
Geo. Dickson, M. A.	A. Robinson, M. D.	R. Bull........	W. H. Ballard, M. A.
Geo. Dickson, M. A.	Wm. Kennedy .	R. Bull........	W. H. Ballard, M. A.
Geo. Dickson, M. A.	Wm. Kennedy .	R. Bull........	W. H. Ballard, M. A.
Geo. Dickson, M. A.	A. Alexander...	R. Bull........	Wm. Turnbull.
Geo. Dickson, M. A.	A. Alexander...	R. Bull........	A. Gaviller.
Geo. Dickson, M. A.	A. Alexander... F. S. Sc.	R. Bull........	A. Gaviller.
H. B. Witton, B. A.	A. Alexander... F. S. Sc.	R. Bull........	A. Gaviller.
H. B. Witton, B. A.	A. Alexander .. F. S. Sc.	R. Bull........	A. Gaviller.
H. B. Witton, B. A.	A. Alexander... F. S. Sc.	R. Bull........	A. Gaviller.
H. B. Witton, B. A.	A. Alexander... F. S. Sc	R. Bull........	A. Gaviller.
Thos. Morris, Jr.	A. W. Stratton, B. A.	R. Bull........	A. Gaviller and G. M. Leslie.

Members of Council.

1857—Judge Logie; Geo. Lowe Reid, C. E.; A. Baird; C. Freeland.

1858—Judge Logie; C. Freeland; Rev. W. Inglis, D. D.; Adam Brown; C. Robb.

1859—Rev. W. Inglis, D. D.; Adam Brown; Judge Logie; C. Freeland; R. Bull.

1860—J. B. Hurlburt, M.A., LL.D.; C. Freeland; Judge Logie; R. Bull; Wm. Boultbee; Dr. Laing.

1871—Geo. Lowe Reid, C. E.; Rev. W. P. Wright, M. A.; A. Macallum, M. A.; A. Strange, M. D.; Rev. A. B. Simpson.

1872—Judge Proudfoot; Rev. W. P. Wright, M. A.; John Seath, M. A.; H. D. Cameron; A. T. Freed.

1873—Judge Logie; T. McIlwraith; Rev. W. P. Wright, M. A.; A. Alexander; I. B. McQuesten, M. A.

1874—Judge Logie; T. McIlwraith; Rev. W. P. Wright, M. A.; A. Alexander; I. B. McQuesten, M. A.

1875—Judge Logie; T. McIlwraith; Rev. W. P. Wright, M. A.; A. Alexander; I. B. McQuesten, M. A.

1880—M. Leggat; I. B. McQuesten, M. A.; A. Alexander; Rev. A. Burns, M. A., LL. D., D. D.

1881—T. McIlwraith; H. B. Witton; A. T. Freed; Rev. W. P. Wright, M. A.; A. F. Forbes.

1882—T. McIlwraith; H. B. Witton; A. T. Freed; A. F. Forbes; Rev. C. H. Mockridge, M. A., D. D.

1883—A. Alexander; A. Gaviller; A. F. Forbes; T. McIlwraith; R. Hinchcliffe.

1884—A. Gaviller; A. F. Forbes; T. McIlwraith; R. Hinchcliffe; W. A. Robinson.

1885—W. A. Robinson; S. Briggs; G. M. Barton; J. Alston Moffat; A. F. Forbes.

1886—J. Alston Moffat; Samuel Slater; Wm. Milne; James Leslie, M. D.; C. S. Chittenden.

1887—J. Alston Moffat; James Leslie, M. D.; P. L. Scriven; Wm. Milne; C. S. Chittenden.

1888—J. Alston Moffat; B. E. Charlton; T. W. Reynolds, M. D.; S. J. Ireland; Wm. Kennedy.

1889—T. W. Reynolds, M. D.; S. J. Ireland; William Turnbull; A. W. Hanham; Col. Grant.

1890—Col. Grant; A. W. Hanham; W. A. Robinson; A. E. Walker; Thomas Morris, Jr.

1891—Col. Grant; W. A. Robinson; Prof. McLaughlin; Dr. Reynolds; W. Turnbull.

ABSTRACT OF MINUTES

OF PROCEEDINGS OF THE

HAMILTON ASSOCIATION

FOR SESSION 1890-91.

THURSDAY, NOVEMBER 13th, 1890.

The President, Mr. Charlton, in the chair.

The minutes of the previous meeting were read and confirmed.

Several additions were reported to the Library and Museum from Mr. Whiteaves, of Ottawa; Mr. John A. Barr and others. On motion the thanks of the Association were voted to the donors.

The Secretary gave an abstract of what had been done during the recess.

Some of the members having expressed a desire to have a Section, or Sub-section organized for the study of Philology, it was resolved to form such a Section, to be known as a Sub-section of Section G.

The following names were then proposed for membership, viz: William Marshall, C. W. Mulligan, Sidney Saunders, J. A. Locheed, F. H. Yapp, Robert L. Edgar, J. S. Fielding, C. S. Mason, George Lynch-Staunton, F. H. Lynch-Staunton, P. L. S.; Geo. M. Leslie, A. W. Stratton, B. A.; H. P. Bonny, W. H. Schofield, B. A.; Hénry S. Moore, J. F. McLaughlin, B.A.; D. Clarke, L. D. S.; Walter H. Elliott, Ph. B.; Hon. Donald McInnes, George Roach, J. G. Cloke, C. S. Finch, Thomas Lees, R. T. Lancefield, Charles Moore and J. J. Morrison.

The President then delivered the opening address of the session. The address was a very interesting one, and dealt with the early history of Hamilton and its neighborhood. At the close of the Paper a very interesting discussion took place, in which the Rev. Dean Geddes, Sheriff McKellar, Senator McInnes, Geo. S. Mills, Mr. Gaviller, F. W. Fearman, Mr. Witton, Jr., and others took part.

The meeting then adjourned, to meet on the second Thursday of December.

THURSDAY, DECEMBER 11th, 1890.

The President, Mr. Charlton, in the chair.

The minutes of the previous meeting were read and confirmed.

The following contributions were reported to the Museum and Library, viz.:—Three fine specimens of fossil ferns from the Nova Scotia Coal Measures, presented by Adam Brown, Esq., M. P.; poisonous insects and reptiles from Central America, presented by W. A Robinson; and a case of parrots from Mr. A. E. Walker; first annual report of the geological survey of Texas, with several pamphlets relating to the same survey, presented by Mr. Wm. Kennedy, now assistant geologist of Texas.

The thanks of the Association were voted to the donors.

Dr. Burgess, Superintendent of the Protestant Hospital for the Insane, Montreal, was elected an honorary member of the Association.

The following were elected ordinary members of the Association, viz:—

Wm. Marshall, C. W. Mulligan, Sidney Saunders, J. A. Locheed, F. H. Yapp, Robert L. Edgar, J. S. Fielding, C. S. Mason, George Lynch-Staunton, F. H. Lynch-Staunton, Geo. M. Leslie, Thomas Lees, Charles Moore, A. W. Stratton, B. A.; H. P. Bonny, W. H. Schofield, B. A.; Henry S. Moore, J. F. McLaughlin, B. A.; D. Clarke, L. D. S.; Walter H. Elliott, Ph. B.; Hon. Donald McInnes, George Roach, R. T. Lancefield, J. G. Cloke, C. S. Finch and J. J. Morrison.

The following names were proposed, viz.:—J. M. Burns, E. L. Rastrick, J. T. Crawford, B. A.; J. B. Turner, B. A.; Frederick Jas. Rastrick, A. H. Hemming, Commander Cheyne, R. N.; J. G. Witton, B. A.

Mr. Charlton then quoted several authorities to verify his statements respecting the existence of Slavery in Canada in the early part of the present century, some of these references showing that there were slaves held in Ontario as late as the year 1811 at least.

In the absence of Mr. Wilkins, of Beamsville, the Secretary read a paper on the Surface Geology of the County of Lincoln and

the neighboring Counties. The paper contained a great amount of original matter, the result of the author's personal observations.

Prof. McLaughlin, W. A. Robinson, Colonel Grant, Mr. Walker and others took part in the after discussion.

The meeting then adjourned.

THURSDAY, JANUARY 8th, 1891.

The President, B. E. Charlton, in the chair.

The minutes of the previous meeting were read and confirmed.

The Curator reported several donations to the Library and Museum.

The following were elected members of the Association, viz:—J. M. Burns, E. L. Rastrick, J. T Crawford, B. A.; J. B. Turner, B. A.; Frederick James Rastrick, A. H. Hemming, Commander Cheyne, R. N.; J. G. Witton, B. A., and the following were proposed for membership, viz:—O. J. Brown, M. A.; S. A. Morgan, B. A; L. T. Locheed, B. A.; J. R. Chapman, J. E. P. Aldous, B. A.; Thomas C. Mewburn, Inspector of Customs.

Mr. Witton then read his paper on "Egypt," with an account of the "Book of the Dead," beautifully illustrated by the British Museum facsimile of the papyrus seventy feet long, written at the end of the fourteenth century B. C.

Several members took part in the after discussion, all speaking highly of the interesting character of the paper.

Mr. Witton kindly consented to allow the illustrations to remain on view for another two days.

Many of the members and their friends availed themselves of the opportunity to examine these very interesting papyri.

The meeting then adjourned.

THURSDAY, FEBRUARY 12th, 1891.

Regular monthly meeting of the members.

The President in the chair.

The minutes of the previous meeting were read and confirmed.

Donations to the Library and Museum were reported by the Curator, Mr. Gaviller.

The following new members were then elected, viz.:—Oliver J.

Brown, M. A.; L. T. Locheed, B. A.; J. R. Chapman, S. A. Morgan, B. A.; J. E. P. Aldous, B. A.; Thomas C. Mewburn, Customs Inspector; and the following were proposed for membership, viz.:—F. G. Foster, Florist, and Rev. H. Birkenthal.

Some very interesting notes were read by the Secretary, from Mr. Wm. Yates, of Hatchley, on his observations among the birds and flowers, which gave great pleasure to the members present.

A lengthy but able paper, entitled "Connecting Links," by H. B. Small, of the Department of Agriculture, Ottawa, was read by the Secretary.

There was not time after the reading of the paper to enter upon a discussion of the various subjects touched upon; it was therefore suggested that the paper be dealt with by the Sections.

It was announced that the next paper would be by Mr. Aldous, on "Flutes of the time of Moses," recently found in Egypt.

The meeting then adjourned.

THURSDAY, MARCH 12th, 1891.

The President, Mr. B. E. Charlton, in the chair.

Owing to the illness of Mr. Alexander, Mr. H. P. Bonny acted as Secretary. Minutes of former meeting read and confirmed.

Mr. F. G. Foster, Florist, and Rev. H. Birkenthal, were elected members of the Association.

Mr. Gaviller reported the receipt of Transactions of the Royal Society of England; the Bulletin of Harvard University; Psyche and the Entomological Magazine for March. He also announced the following donations to the Museum, viz.:—A quantity of wampum, presented by Mr. Allison, of Waterdown; specimens of copper ore, iron and manganese ores from Western Virginia, presented by Mr. G. Meakins; asbestos from the Eastern Townships of Quebec, given by Mr. E. Furlong; and lead ore from Missouri, presented by Mr. W. D. Long.

A vote of thanks to the donors was proposed by Mr. H. B. Witton, seconded by Mr. Bull, and carried.

A very interesting paper on the "Flutes of the time of Moses," was read by J. E. P. Aldous, B. A., elucidated by diagrams. The subsequent discussion was joined in by Messrs. Briggs, Witton, the President and others.

Mr. Briggs then read some instructive notes on domestic animals, by Mr Wm. Yates, of Hatchley.

The President announced that the next paper would be read by Mr. J. T. Crawford, B. A., and be entitled "Applications of Electricity," illustrated by experiments.

The meeting then adjourned.

THURSDAY, 9th APRIL, 1891.

The President, Mr. B. E. Charlton, in the chair.

The minutes of the previous meeting read and confirmed.

Mr. Charlton called attention to the transit of Mercury on the 9th May next, and that through the kindness of Chief Aitchison, of the Fire Brigade, the use of the fire tower had been secured as an observatory for the occasion. He also intimated that some of the best telescopes would be in position on top of the tower, and that there was ample room for sixty people.

The Curator reported several additions to the Library.

William M McClemont, law student, and S. B. Sinclair, B. A., were proposed for membership.

J. T. Crawford then gave his lecture on "Electricity as a source of Light and Heat." The subject was very clearly treated and made interesting by numerous experiments. He also explained, by means of experiment, the various contrivances for lighting and extinguishing gas lights.

At the conclusion many expressed the pleasure they had received in listening to the subject as it had been treated.

It was resolved to organize a Section for Physics.

At the close it was announced that A. Alexander would read a paper on some botanical subject at the next meeting, and that the meeting would be the annual one for the election of officers for the ensuing session and other necessary business.

THURSDAY, MAY 14th, 1891.

The President in the chair.

The minutes of the previous meeting were read and confirmed.

S. B. Sinclair, B. A. and W. M McClemont were elected members of the Association.

Mr. Alexander read a paper which he called "Botanical Jottings."

After remarks on the paper the annual meeting of the Association was held, at which the following reports were read :—

Report of the Council,	by A. Alexander.
Biological Report	" Dr. Reynolds.
Geological "	" A. T. Neill.
Philological "	" A. W. Stratton.
Conchological "	" G. M. Leslie.
Financial "	" R. Bull.

Votes of thanks to the retiring President, Secretary and other officers followed, when the election of officers for the ensuing session took place, resulting as follows :—

President,	A. Alexander, F. S. Sc.
1st Vice-President,	A. T. Neill.
2nd Vice-President,	Samuel Briggs.
Corresponding Secretary,	Thomas Morris, Jr.
Recording Secretary,	A. W. Stratton, B. A.
Treasurer,	Richard Bull.
Curator and Librarian,	Alexander Gaviller.
Assistant do.	G. M. Leslie.

COUNCIL.—W. A. Robinson, Colonel C. C. Grant, Prof. McLaughlin, Dr. Reynolds and William Turnbull.

AUDITORS.—J. M. Burns and George Black.

The meeting then adjourned to meet on the second Thursday of November.

Hamilton Association.

SESSION 1890-91.

INAUGURAL ADDRESS

DELIVERED BY B. E. CHARLTON, ESQ., (PRESIDENT), ON NOVEMBER 13th, 1890.

After welcoming the members to the Association's new quarters, he said that he had chosen as the subject of his address, "Notes and Incidents in the Early History of Hamilton and Vicinity":

Perhaps the earliest recorded visit of any white man to this part of the Province of Ontario was that of the Jesuit fathers, Brébeuf and Chaumonont, in 1640. In 1634 these two missionaries, with others, attached themselves to a party of Huron Indians, whose home was near Lake Simcoe, then visiting the present location of Three Rivers, in the Province of Quebec, on a trading expedition, and returned with them by the way of the Ottawa and French Rivers and Lake Nipissing. After that long and toilsome voyage in bark canoes, the intrepid fathers found themselves floating on the broad bosom of a mighty inland ocean, which the Indians called Attiguantan, but which they named La Mer Douce, or the fresh water sea. This is now known as Georgian Bay. On the southern shore of this bay, and between that and Lake Simcoe, they found populous Indian towns, the homes of the Hurons. There they labored with that zeal and courage for which their Order has always been noted, but apparently with very indifferent success. After residing in this place six years, the two fathers named above were selected to penetrate the country of the Kahquas or Neuters, a numerous tribe inhabiting the country lying between the Niagara and Detroit Rivers, and between Lakes Erie and Simcoe, lying chiefly around the head

of Lake Ontario, while a wing of their territory extended across the Niagara river into Western New York. After five days' march from the most southerly Huron town, situated near the present village of Oro, ten miles north-east of Barrie, they reached the first village of the Kahquas, and afterwards visited in turn eighteen others. The Kahquas were a fierce people. In athletic proportions, ferocity of manners and extravagance of superstitions, they were never exceeded by any other North American tribe. They, like their neighbors the Iroquois, and Hurons too, on some occasions tortured and roasted their captives alive for hours, and, when life could no longer be prolonged, ate them. The mission was barren of any other fruit than extreme hardship and danger; but from the distance travelled, and the number of towns visited, it is quite probable that these two Jesuits visited the head of Lake Ontario.

Whether they did so or not, it is certain that La Salle, that most intrepid explorer, in company with other Jesuit missionaries, namely, de Casson and de Galinée, encamped several days on the north shore of Burlington Bay, and on Sept. 24th, 1669, visited the Iroquois town near Lake Medad, the particulars of which visit are recorded in the Journal of this Association for 1882-1883. La Salle's expedition was the first to leave any written record of Burlington Bay, and he has therefore been appropriately designated as its discoverer.

Between these two missionary visits the small-pox—that disease so deadly to the Indian—had swept with decimating effect over the land, and was followed by one incursion after another of the ferocious Iroquois, till not a trace, save the ash heaps, was left of the 30,000 Kahquas and 20,000 Hurons in all the country bounded by the Niagara River, Lakes Erie and Huron and Georgian Bay, a few only of their towns, such as that at Lake Medad (previously referred to), being, according to the Iroquois custom, occupied as outposts by the conquerors.

For another hundred years after La Salle's visit, the only white faces reflected from Burlington Bay were those of a few traders and trappers.

A few stirring events occurred meanwhile about the borders of the Niagara River, as along it ends the grand portage or carrying place, which formed the thoroughfare between Lakes Ontario and Erie. This, indeed, has been the chief Canadian battle-ground of

this country since history began—first, between the Kahquas and Iroquois; next, between the Iroquois and French; next, French and English; next, English and Americans in the two wars of 1776 and 1812; and lastly between Canadians and Fenians.

The old fort at the mouth of the Niagara River, which had been built by La Salle in 1678, was captured from the French in 1759 by Sir William Johnson, commanding a little army of 2,000 English and 1,000 Indians. The youthful warrior Brant, or Thayendinaga, first figured in Canadian history at this battle. Five years later, on the close of the Pontiac war, one of the larges Indian councils ever held upon this continent took place at Niagara. In the spring of 1764 Sir William Johnson, who was married to the sister of Brant and who attained a commanding influence in Indian affairs, from his place called Johnson Castle, near the mouth of the Mohawk, sent out runners all over the north and west, summoning the Indians to meet him in council at the mouth of the Niagara River, and when he, with an escort of 500 Indians, stepped from the canoes by which they had travelled by way of Oswego River and Lake Ontario, he found there assembled an immense concourse of Indians, embracing delegates from all the nations dwelling in that vast region between the pine forests of Nova Scotia and the head springs of the Mississippi, the margin of Hudson's Bay and the shores of Lake Superior. The Sioux and Pottawattamies alone were absent, conscious of their own misconduct and afraid to trust the English, whom they had greatly injured. The task before Sir William was a delicate one—that of threatening some, conciliating others and moulding these various tribes, many of whose delegates were red-handed from the massacres of Michillimackinac and Bloody Run, into friends and allies. The council lasted for over a month, and proved of great benefit to the British and to the cause of peace.

Twelve years later the American revolution broke out, lasting from 1776 to 1783, resulting in the Mohawks under Brant fleeing to Canada and settling upon a grant of land upon the Grand River, formerly called the Ouse. Brant established his headquarters at what is now the small village called Mohawk, one and a-quarter miles from Brantford, where is at present the small church which Brant established, which was the first church ever erected in Ontario. In it is still preserved a massive silver communion service, presented to the tribe by Queen Anne in 1710, while they

resided upon the Ohio River. Here Brant lived in a style which, for an Indian, might be called regal magnificence—the idol of his nation and its greatest living warrior, attended by numerous slaves, both of African and of Indian blood. What an elevation for an Indian to attain! The locality had been selected with that skill and sagacity for which the Indian is noted. No place in Canada could have answered the wants of his people so well. The flats of the Grand River were and are proverbial for their rich soil—the best in the Dominion for the cultivation of Indian corn. Game, wild fowl and fish were abundant, and white settlers had yet scarcely disturbed nature's own handiwork. It was virtually an Indian's paradise.

One Capt. Campbell, of the Forty-second Regiment, stationed at Niagara in the winter of 1791-2, relates how himself and others, in two sleighs, made a trip from Niagara to Mohawk and return for the purpose of visiting the great chief. The account which he gives throws considerable light upon the condition of the country at that time, and the style in which Brant lived.

The first night they put up at Squire McNab's, which was more than fifteen miles from the Niagara River; the second, at Smith's, near the North-west corner of the present King and Wellington streets in this city; the third, at Paisley's, and next day at Mohawk. He speaks of Burlington Bay as Lake Geneva, and says the Indians called it Ouilqueton. Other writers say it was once called Macassa, possibly by the former occupants of the country, the Kahquas. Himself and party were most hospitably received by Col. Brant, whom he found living in the grand style mentioned before—the table loaded with excellent china and attended by two slaves in silver buckles and ruffles and scarlet dress. The house was supplied with good furniture. Brandy, port and Madeira wines and other European delicacies in considerable variety were freely dispensed. Mrs. Brant was dressed in the Indian style, but her costume was made of satin and broadcloth, with blanket of silk. On Sunday all attended church, at which an Indian conducted the service, and Capt. Campbell was charmed with the singing of a choir of Indian women. The same evening a great war and serpent dance took place, Chief Brant himself beating a drum. The dance ended with Scotch reels, in which all, the Europeans included, took a hand. He speaks of the excellence of the land and the comfortable habitations of the Indians scattered pretty thickly along both sides of the Grand River; of the

abundance of fish—sturgeon, pike, pickerel and maskinonge—in the river, and game in the woods.

Returning down the river through several Indian villages, he stopped the first night at the house of W. Young, a half-pay officer married to a squaw; next day crossed a forest of twenty miles without a settler, stopped at Mr. Andrew Patton's, called at Major Tinbrook's and dined at Squire McNab's. This Mr. McNab (not a relative of Sir Allan's), he says, "is a gentleman of genteel and independent property—is a justice of the peace, which gives him the title of squire, and a member of the land board." He further describes their arrival at the Fort of Niagara, and going on to Chippawa for a dance the same night.

Burlington Bay was a favorite fishing ground of Brant's tribe at the seasons of the year when wild duck and fish were most abundant, and the chief having obtained a grant of 600 acres bordering the north-east angle of the bay, established his next and final residence there, where he died in 1807.

Besides the Indians who came to Canada at the close of the American revolution, numbers of loyalists who, through the war, had espoused the side of the British and preferred still to be sheltered by the old flag, also came over and commenced settling along the frontier and gradually extending into the interior. Governor Simcoe, first governor of Ontario (or Upper Canada), arrived at Niagara, then called Newark, in 1791, and established his government, afterwards in 1796 removing to Toronto, then Little York, described at the time as a miserable collection of shanties. It bore the title of Little York till 1817, when a change to Toronto was made, lest it might be confounded with New York. One of Governor Simcoe's first acts was to send out surveyors, who laid out districts and counties, liberally distributing among them names of places in Yorkshire, such as Barton, Flamboro', Ancaster, etc.

It is not pleasant to remember that human slavery once cast its dark shadow on this beautiful province; and as I have mentioned that Chief Brant held slaves, a fact which some may be unwilling to believe, it may be necessary for me to state that a mild patriarchal form of slavery existed in Canada at this period—was permitted, indeed, from the date of the proclamation of King Louis in 1689 to that of the Imperial act of 1833, which freed the slaves of the British West Indies and embraced those of Canada likewise.

J. C. Hamilton, LL. B., in a paper which he recently read before the Canadian Institute, stated that in the year 1791 there were some three hundred negroes and a few Pawnee Indian slaves in Upper Canada, mostly in and around Niagara, and that Sir Adam Wilson informed him of having met, about 1830, two young slaves, "Hank" and "Sukey," at the residence of a lady in the County of Halton, mother of a distinguished resident of this city, who died a few months ago. These took their freedom under the Act of 1833, and were perhaps the last slaves in the Province. Since that date, however, for half a century, Canada afforded such a refuge and a home to the fleeing sons of Africa as to have effectually wiped out the dark stain.

In the old burying-ground attached to the Christ Church Cathedral stands a tombstone bearing the following inscription : "In memory of Richard Beasley, who departed this life on the 16th day of February, 1842, aged eighty years and seven months. The first settler at the head of the lake." The honor of being the first settler here is claimed also by Col. Robert Land.

It is quite probable that a few settlers might be located here before the arrival of Governor Simcoe's surveyors, by whom the site of Hamilton was divided into farm lots east and west by Main street —King street being established upon an Indian trail and not sufficiently straight for a dividing line. At a very early date, south of Main street, James Mills, father of the late Hon. Samuel Mills, owned all lying west of Queen street; Peter Hamilton, between Queen and James; George Hamilton, between James and the line of Mary street; Richard Springer, from Mary to Wellington; and Ephraim Land, from Wellington to Wentworth. On the north of Main street, Peter Hess owned all west of Bay street; Samuel Kirkendall, from Bay to James; Nathaniel Hughson, from James to Mary; Archibald Ferguson, from Mary to Wellington; Robert Land, from Wellington to Emerald; and Abel Land, from Emerald to Wentworth.

Previous to 1832, Hamilton extended no further west than Queen, nor east than Wellington street. The latter was known as Lover's lane, at the foot of which stood the only wharf.

The site of Hamilton was very broken, being traversed by numerous creeks, which took their rise at the foot of the mountain, thence winding their way to the bay. There are those now living who remember speckled trout being caught in a creek at the rear of

the Boys' Home, near the corner of Stinson street and Erie Avenue, and in another at the corner of King and Jarvis streets; others who have seen canoes and skiffs in a third creek near the Royal Hotel, corner of James and Merrick streets, which creek was navigable for that kind of craft from thence to the bay. The only son of Sir Allan Macnab lost his life by the accidental discharge of his gun while leaping across the same stream near the corner of Hughson and Augusta streets.

It is worthy of note that we have in the city one organization, and one only, still in active operation which was established in this place in 1795, eighteen years before its name was Hamilton—twenty-nine years before it had a regular church building. Older than any structure in the city to-day, The Barton Lodge of Freemasons stands unchanged, amid a scene of change, except that its meetings and festivities are held in a palatial hall, or temple, instead of a lodge-room of logs. Its records tell of the first meeting for organization at Smith's tavern, which stood, as before mentioned, at the north-west corner of King and Wellington streets, and that after the meeting the brethren marched in procession to the house of Bro. Beasley, (Dundas), where Bro. D. Philps preached a sermon, and that Bro. Brant, the great chief, was in the procession. The records show also that at that early date the nearest store was at Niagara, whither the brethren usually went on horseback to purchase the necessary articles, as writing paper and ink-powder.

The Road from Toronto to the head of Burlington Bay was cut out in 1811, and Hamilton laid out as a village in 1813. In 1833 it was incorporated as a town, but the population in 1830 was only 653. In the same year the population of Toronto was 2,860 or about four and a-half times greater.

It is worthy of note that the corner of King and Wellington streets is the location of Hamilton's first tavern, first Masonic lodge, first school and first church. The first regular church building was erected on the site of the present First Methodist Church, on land donated by Col. Robt. Land in 1822. It was dedicated in 1824. The first interment was that of Samuel Price, tavern-keeper, in 1822. One of the oldest marble slabs in the burying-ground attached thereto reads as follows: "Sacred to the memory of Capt. John McKeen, who was a partner with James G. Strobridge for the construction of Burlington Bay Canal, who died Sept., 1824. This monument was

erected by J. G. S., 1831." Mr. Strobridge was interred in the same place two years later.

Burlington Bay Canal was commenced in 1823 and completed in 1826, the width being only thirty feet. Prior to the building of this canal Ancaster was the county-seat, having in 1818 twenty prosperous stores; but many of her most enterprising business people, such as Edward Jackson, Richard and Samuel Hatt, etc., removed to Hamilton on the opening of the said canal. Afterwards, in 1846, the canal was greatly widened. The contractor for the job, in order to bring stone for the piers from the north mountain, near Waterdown, built a tramway. This tramway equipment was afterwards sold to Andrew Miller, who had a project to build a canal from the bay up the ravine in rear of the Spring Brewery to the intersection of Bay and York streets. It is said that he obtained from Messrs. Hess and Kirkendall thirteen acres of land in the said ravine at a very small price, the chief consideration being that he should build the said canal. When people became impatient at his slow progress with the canal, he finally said he would complete the job at the date fixed by his deed, but upon examination of the deed it was found that no date had been mentioned.

For a long time "Mountain Road," now John street, was the only road leading from Hamilton to the brow of the mountain. On it were built some of Hamilton's first stores, notably one at the northeast corner of Jackson street, kept by Rolston, and one at the southeast corner of King street, kept by Sheldon. Later on some enterprising property owners opened up James street to the top of the mountain and celebrated the event with great éclat, proclaiming that it would draw the Ancaster and surrounding country trade through it at the expense of John Street, and that in consequence the latter would soon be abandoned as a business street. To emphasize their statements they hired a farmer to sow John street with grass seed. Commencing at the corner of King street, the agriculturist went southward scattering his seed until reaching the log jail, from the rear of which he met a shower of odorous eggs, which caused him to beat a quick retreat.

The old log jail, erected in 1861, stood on a slight elevation on the east side of John street, directly opposite the eastern entrance to the present Court House. It faced the west, but stood a little back from the street, leaving room for the pillory and stocks in front. In it impe-

cunious debtors, and others more criminal, were often incarcerated. A prisoner on one occasion sent word to the sheriff that if he did not make better fires and keep the place warmer he would leave. Another prisoner, named David Springstead, burrowed under the logs and escaped temporarily, and was thenceforth named "the Fox." Here an incident worth relating occurred at an early day. Three brothers named Young were accused by a prisoner confined in the jail of having killed a man, whose body, he said, he saw them deposit in the interior of a burning charcoal pit. The brothers were arrested, but after an exciting trial were acquitted. Upon gaining their liberty one of the number named John, proceeded to the United States and succeeded in finding the party whom they were accused of murdering. Both returned together, and the wretch who had endeavored to have three innocent men executed was sentenced to three months' imprisonment, during which he was to stand three times in the pillory, two hours each time, on which occasions he was pelted unmercifully with stale eggs. The log jail gave place in 1828 to a stone jail and court house combined, on the site of the present court house, to which it also gave place in 1877.

The venerable bell which now rings out the alarms of fire from the high tower at the Central fire station with such promptness, making the faithful firemen and horses spring to the call of duty, has quite a history. It was purchased from a manufacturer in Troy, N. Y., in 1836, for £100, and one of the first four debentures ever issued by the corporation of the town of Hamilton was given in its payment. Therefore, it would seem appropriate to designate the old bell as the father of the city debt. It first swung from the belfry of a wooden church on John street, a little south of Rebecca street, where the Gurney company's foundry now stands. In 1840 it was removed to a tower on the roof of a building on King William street, which forms part of the present central fire station, which building has been in turn town hall, lock-up, police court, and lastly fire station. About 1874 the bell was removed to the clock-tower on the old market house and city hall, and finally in 1888 it was removed to the present fire-tower at the Central station.

We have seen from what small beginnings and within a single lifetime, Hamilton has risen from a few scattered log shanties, where industrious and hardy settlers were heroically shouldering back the crowding forest, to this beautiful city, filled with so many

happy homes—the home not so much of collossal fortunes as some neighboring cities under another flag, but where genuine comfort is more uniformly distributed and less abject poverty prevails. There are those living who have seen corn and potatoes growing where now stands our stately court-house, and an orchard on the site of our superb city hall.

Hamilton is now a city of clean streets, good schools and comfortable and elegant churches; of swelling factories, whose busy wheels give out the hum of healthy industry—a city in whose beautiful setting and surroundings nature has been lavish. Her head pillowed on the breast of the mountain, her bosom on the plain, and her feet touching the waters of the bay, who would not love her, Hamilton the ambitious, the delightful?

NOTES UPON THE SURFACE GEOLOGY OF LINCOLN COUNTY, ONTARIO.

Read before the Hamilton Association, December 12th, 1890.

BY D. F. H. WILKINS, B. A., BAC. APP. SCI., HEAD MASTER HIGH SCHOOL, BEAMSVILLE.

The present paper must be understood to be a mere outline, a connecting link between the writer's previous description of the River Valleys of the Niagara Escarpment and a subsequent essay which will describe more fully the features now merely hinted at. In excuse for the somewhat deceptive title of the present effort, the writer must plead engagements which have of necessity confined his observations to a somewhat limited district. Moreover, in order to connect fully the present paper with the former, the attention of the Association is asked to some features lying beyond the limits of the County of Lincoln, which, nevertheless, the writer thinks necessary for the proper development of his subject. The importance, therefore, of the surface geology of the region extending from Hamilton to Niagara, together with that of the district sloping southward to Lake Erie, requires far more development than that contained in the few scattered notes here laid before you.

Now, since it is advisable to deal with those phenomena nearest the region in question, your attention is asked to a section exposed on Lot 13, Con. 1, Clinton Township, this being as near a typical series as can be found, with perhaps one exception to be noted. Again, it must be remembered that the Medina shale, unaltered, forms the surface soil in many localities, overlaid here and there by a layer of vegetable mould of a few inches in thickness. The section referred to shows in descending order:—

1. Surface soil, yellow loam—1 foot.

2. Stratified brown clay, full of boulders, stones and small pebbles—1½ feet.

3. Brown-red clay, stratified, full of Medina pebbles, red and green, Hudson River fragments, all strongly impregnated with calcium chloride—6 feet.

4. The Medina Shale.

In a direction N. 20° E. from this exposure, eleven feet in vertical height lower and six hundred feet in horizontal distance, we have:—

1. Red and green sandy clays with a few Hudson River boulders—3 feet 11 inches.

2. Reddish-brown clay impregnated with sodium sulphate—1 foot.

Following the strike of this bed for forty feet six inches in a direction N. 60° W. we reach a stretch of sixty-two feet, measures concealed, then an outcrop of reddish clay, averaging from three to four feet, in a direction N. 40° E., then, at a distance of one-sixteenth of a mile north of the second outcrop, on a section striking N. 40° E. for seventy-two feet, we have in descending order:—

1. Red-brown sandy clay—3 feet 2 inches.

2. Red-brown clay with pebbles—4 feet.

3. Red-brown clay, strongly impregnated with calcium chloride, intersected by joints N. 60° E. and N. 41° W.—4 feet.

This last outcrop lies about twenty-three feet below the first, showing thus a small dip towards the lake.

Except for the presence of sodium sulphate and of calcium chloride, the foregoing may be taken as a fairly typical section, as has been already stated, and from the point last mentioned about a quarter of a mile of lacustrine sand overlies the clay as far as the lake shore. On the lake shore the banks are composed of brown clay, stratified yet unfossiliferous, capped with sand. It may be here added, too, that about a quarter of a mile of sand and clay beds has been, within the last fifty years, washed into the lake—that the lake margin then was nearly a quarter of a mile seaward from the present position. But this account is merely traditional, and must be received as such; and a far more interesting fact awaits us on turning our looks towards the land. For about fifty feet above the lake and about a mile and a-quarter south of the present margin, there extends a true boulder pavement—a ridge of boulders or "field stones," rising about three to six feet above the general level, parallel to the present lake margin. Its material has evidently been derived from a lake terrace, to be noted immediately. It is distinctly stratified and corresponds to Burlington Beach of to-day. It is worthy of note that the deposits to the south of the boulder

pavement are more clayey than sandy, while to the north the sand predominates over the clay. The percentage of boulders is in many localities greatly Laurentian, Huronian and Montalban; in others the Hudson River calcareous sandstones predominate, and few, if any, Medina pebbles and boulders are found. It may be added that the boulders are well rounded and as a rule free from ice-marks.

About half a mile to the south lies the famous Second Terrace, the ancient lake margin, of which Burlington Heights is the continuation. This beach, as has been shewn by other observers, enters the Province at Queenston Heights, follows the escarpment to Hamilton, forms there the Burlington Heights, and runs on across the Counties of Wentworth, Halton, Peel, York, Ontario, Northumberland and West Hastings. While in the last locality the ridge rises to the height of over four hundred feet, at Beamsville the average elevation is about sixty feet, or about a hundred and ten feet above the present lake level. It is composed of stratified brown clay full of boulders in many places, the boulders being of the same character as those of the boulder pavement. Strange to say, however, here and there, especially on the Thirty Mile Creek, the terrace is composed of unaltered Medina deposits, the conditions for excavation having been favorable and those for deposition the reverse.

But this second terrace slopes gradually southward and upward to a third beach, which abuts against the lower Niagara escarpment; here and there it rises suddenly, but in general its slope is gradual, with billowy, sweeping outlines. While here and there in the valleys of the creeks which cut into the deposits, the Medina series, grey band at the top and all, may be seen, the material of this beach seems to be in general a lighter brown clay, here and there containing boulders and pebbles, principally Archæan or Hudson River in age.

The fourth beach is, as has been said, the lower escarpment, the Pentamerous limestone, at the base of the Niagara series. Very often the beach is semi-circular in form, as may be seen near Beamsville, near Grimsby, and near Stony Creek. It may show upon unexposed surfaces deposits of clay and sand, but as a rule these are absent, for a reason suggested above. On exposed surfaces, however, ice-marks and grooves are plentiful, and seem to be due to coast-ice

exclusively. The writer trusts that he may here digress sufficiently to note the importance of coast-ice as a denuding and polishing agent. On the Labrador coast may be seen hard gneissic rock, polished, grooved and scooped, *not by glaciers*, but by coast ice, raised and lowered by the tide. While it has been distinctly shown that a glacier *cannot erode*, or can erode but slightly, coast ice certainly can accomplish a heavy task in denudation, as it was the writer's privilege to verify in 1875. Amongst other phenomena he then noticed that the polishing and grooving were not conspicuous towards the summits of the hills of that forbidding rocky coast, but that between and above the tide-marks they were a conspicuous feature.

From the fourth beach the land rises to the upper Niagara escarpment in a series of billowy clay loam fields, the escarpment itself constituting a well-marked terrace. As on the lower escarpment, ice-marks are plainly visible, scratching, polishing and rounding being as usual very conspicuous. The general direction of these marks, it may be added, is plainly about S. 68° E., though it may appear that a second series of striæ crosses here and there at right angles to this. The action of coast ice is to the writer as plainly demonstrated here as on the Labrador coast, and he regrets greatly that other engagements have prevented a close study of the phenomena.

But most important of all, perhaps, upon the summit of the escarpment, at distances from the edge varying from one-eighth to a quarter of a mile, lies a ridge of brown stratified clay, much heavier in texture, more strongly calcareous and lighter in color than that below the escarpment. The ridge rises to the height of from seventy to ninety feet above the escarpment, and presents a bold, bluff face to the north-east, while it rolls away in gentle slopes to the southwest. This ridge—roughly parallel with the edge of the escarpment —is traceable westward through the County, on through Wentworth to Ancaster Township. Here it constitutes the height of land referred to by Mr. William Kennedy on page 3 of a valuable paper read before this Association in March, 1882. It crosses the H. and N. W. R track near Rymal station at a height of four hundred and ninety-three feet above Lake Ontario. The present writer independently examined this ridge west of Hamilton many years ago, and traced it into Beverley Township. As Mr. Kennedy has stated, it is the water-parting between the streams flowing into Lake Onta-

rio and those flowing into Lake Erie; and yet it is penetrated by all, or by nearly all the creeks which have a north-eastward direction. Thus, near Beamsville, the Twenty and the Thirty Mile Creeks have cut their way through the ridge long after this ridge had been deposited. It is, moreover, the last sea-margin of the former Lake Erie at a time when the highlands of Western Ontario stood far above the water level of that day; and it has been as this sea-margin referred to on page 6 of "River Valleys of the Niagara Escarpment." To the south of the ridge the soil is nearly uniformly brown clay intersected by swamps, and this character is maintained as far south as Lake Erie.

It is worthy of notice that the clay area covers not only great parts of Lincoln and Welland Counties, but also the Townships of Barton, Glanford, Saltfleet and Binbrook of Wentworth, a small part also of Ancaster, and nearly the whole of Haldimand County, together with portions of East and South Norfolk. A line drawn from Concession 2, Lot 3, Ancaster Township, at the mountain edge, south-west to Concession 5, Ancaster Township, thence south-westerly to Onondaga, roughly represents the line between the clay and the overlying sand. The line is next met with about two or three miles east of Oakland, Brant County, about three miles east of Waterford and four to five miles east of Simcoe, near Renton station on the Air Line, reaching Lake Erie west of Port Dover. A subordinate clay area occupies the southern part of Walsingham and Houghton Townships, Norfolk County, evidently a former extension of Long Point Bay. It is worthy of note that by comparison of the levels on the Canada Southern Division of the Michigan Central Railway, those along the Air Line Division of the Grand Trunk, and those along the Buffalo and Goderich Division of the same, the sand stands at a much higher level than the clay area of South Lincoln, Welland and Haldimand. Thus, the sandy deposits along the Air Line near St. Thomas east to Simcoe, have an elevation greater than five hundred feet above Lake Ontario, while from Simcoe east they fall much below this, and from Jarvis east to the Niagara River the clay beds do not exceed three hundred and seventy-five feet. Along the Canada Southern, except at Villa Nova, East Norfolk, the clay never exceeds four hundred and seventy feet, while the sand and gravel beds near Waterford maintain a pretty uniform level of over five hundred and eighty feet. Along the

Brantford, Norfolk and Port Burwell Line the sandy deposits of Oxford County show an average elevation of over five hundred feet, as also do the Oak Plains near Brantford. In 1886, moreover, the writer measured a section exposed in the sandy beds near Lake Erie, in Charlotteville Township, and found it to consist of sand 40 feet, followed by yellow and brown clay, 10 feet, stratified; sand, stratified, 80 feet; blue clay 30 feet, to the edge of Lake Erie; thus giving a total height of one hundred and sixty feet above Lake Erie, or of four hundred and eighty-five feet above Lake Ontario.

The use of these apparent digressions from our subject will be seen when we shew how these bear, or seem to bear, upon the present distribution of clay in the region under consideration—South Lincoln. The clay area having the escarpment for its margin, was evidently cut off to the west by a sand-bar derived from the higher lands of Ontario, and this sand-bar so shaped the currents of the then existing lake as to preserve an expanse of quiet, somewhat shallow water, greatly resembling the present Long Point Bay, this water covering Haldimand, South Wentworth in part, South Lincoln and Welland Counties, a few sandy spots showing yet shallower water. At that time the drainage of Lake Erie was either to the west, along the Wabash Valley reversed, or towards the east as some have supposed, beyond Buffalo to Central New York and to the Susquehanna. Be that as it may, Niagara River then had no existence, the clay and the gravel and sand beds containing recent shells, and now seen at Goat Island and elsewhere, far above the river level, pointing rather to the eastward margin of the former lake. Not until the barrier at Queenston Heights was broken could the drainage of Lake Erie take place as at present; and the cause of the fracture seems to have been mere warping of the earth's crust, even though very small. A more careful examination of the superficial deposits at Queenston Heights may reveal some other cause, and until that time the warping spoken of must be held as provisionally true. Whatever was the cause, it seems to have operated almost simultaneously upon all the streams of the Niagara district, compelling them to break through the barrier, thus draining to a large extent the area of quiet water previously mentioned, and leaving lagoons separated by clay and gravel ridges, from which lagoons by silting up have been derived the present swamp areas of the district in question.

Meanwhile, what was going on at the lower level, Lake Ontario? The deposits were being laid down in a series of terraces, and from the fact that the Medina red rock weathered forms the surface soil in many places, we may infer that powerful currents were carrying eastward much of the clay and sand of that day. The formation of the terraces could easily go on contemporaneously with the deposition of clay and sand in the upper area, and, as the water was drained away, the terraces remained high and dry. Indeed, so far as the writer's observations have gone, all but the second terrace were exposed somewhat suddenly, since there is no boulder pavement a little below their level, as there would be if the water had broken against their faces for a considerable time. Again, as has been said before, in some cases we rise imperceptibly from terrace to terrace over a succession of billowy meadows and fields, which are often intersected by little streams; precisely what we should expect to find in a suddenly drained area. The cause of this sudden drainage has been shewn by Dr. Spencer to be the removal of a barrier of some kind at the Thousand Islands, thus allowing a vast increase in the volume of water pouring seaward down the Saint Lawrence. Meantime the creeks of the district had commenced to cut their way down the escarpment and to form valleys of their own. Probably the second terrace, the most conspicuous feature, occupied more time than the others in its formation, especially since it has been traced so far and so successfully, and since it is fronted by such a well-marked boulder pavement. Finally, the latest deposits were laid down, and the present levels of land and water defined.

To sum up, the writer's observations seem to point to the following phenomena:—

1. A northward extension of Lake Erie, as has been said, the topography of which consisted of a large southward extending sandy island, occupying Oxford, Norfolk, Brant and West Wentworth Counties, as also parts of Middlesex and Elgin. East and west of this were areas of sheltered water, that on the east embracing Lincoln, Haldimand, East Wentworth, northern part, and Welland, having the Niagara escarpment as its northern margin.

2. From some reason or other, a breaking of the barrier at Queenston Heights, a development of Niagara River, and a vast diminution in the volume of water in Lake Erie; simultaneously, a break-

ing of the barrier in various parts and a commencement of many north-eastward flowing streams.

3. At the same time as 1, the formation of a series of terraces in the area of Lake Ontario at a lower level than in the above.

4. The somewhat sudden stoppage of the growth of these terraces due to removal of a barrier of rock at the Thousand Islands.

5. Establishment of the present levels of land and water.

6. It may be noticed that since recent shells have been found in the beds of Goat Island, and in those along the Niagara River—and also, since in the brown clays of Walsingham Township, Norfolk County, underlying the sand, the writer has found leaves of the red maple, the birch, the poplar and several willows—therefore, geologically speaking, the time occupied in the development of the above must have been very recent.

Lastly, the above must be taken to be a first crude summary rather than a finished detail—a suggestive or would-be suggestive outline, rather than an exhaustive picture.

EGYPT, AND SOME ACCOUNT OF THE BOOK OF THE DEAD.

Read before the Hamilton Association, January 8th, 1891.

BY H. B. WITTON, ESQ.

For ages the land of Egypt has commanded the attention of antiquarians, historians, warriors, statesmen and travellers. To this day, thoughtful men of many countries turn towards Egypt a longing lingering look, for since the dawn of civilization shed a glimmering light upon the earth, in the far background of the picture of man's doings, where all is hazy, indistinct, and almost lost in the aerial perspective of the past, Egypt shows a distinct if faint outline. Who but has felt some interest in that land? In youth we eagerly read of Joseph, and his brethren who sold him as a slave into Egypt; of his eventful life; his interpretation of Pharaoh's dreams; his exaltation; his provision against famine, and relief of his family who for fear of hunger had gone down into Egypt to seek food. And with what zest we read on how Joseph made himself known to his brethren; and how the Israelites settled in Egypt and increased in numbers, so that they threatened to overrun the land; and how Pharaoh, having recourse to sterner measures than modern Malthusians have ventured to suggest, commanded that the male children of the Israelites should be put to death; and further on we read how the mother of Moses, to screen her child from that cruel edict, hid him in an ark of bulrushes, which she floated on the Nile, where he was found by the King's daughter, who adopted him as her son; of his sympathy for the wretched, his gifts as a leader and lawgiver, and of the Israelitish oppression and exodus. These narratives are indelibly impressed on the memory. We never forget them, and they whet the desire to learn something of the researches of Champollion, Lepsius, Petrie and the other Egyptologists of the nineteenth century.

Hardly less interesting than Egypt itself is the river by which it has been formed; for the saying of Herodotus, more than two thousand years ago, that Egypt is the gift of the Nile, is literally

true. We marvel at the Thames and Mersey, as thronged highways of modern commerce; at the beauty of the Rhine; at the stretches of the Amazon or St. Lawrence; and at the Ganges, held in veneration as a sacred stream by millions; but the Nile has characteristics which are unique and which surpass them all. Through that immense region of desert which stretches from the Atlantic Ocean across Africa and far into Asia, the Nile is the only river powerful enough to force its way northwards from the equator to the sea. Starting from the mountains which skirt the great central basin of Africa, the Nile traverses in all a distance of four thousand miles. From the confluence of the Blue and White Nile at Khartoum to the embouchure of the river into the Mediterranean, it extends over fifteen degrees of latitude, and, taking into account its numerous bends, runs in that course about 1800 miles. A short distance below Khartoum it receives one tributary, but after that, for more than a thousand miles, it is fed by neither stream nor brooklet, as there is nothing on either hand but an arid desert. As Leigh Hunt pictures it in his beautiful sonnet:

> "It flows through old hushed Egypt and its sands,
> Like some grave mighty thought threading a dream.
> And times and things, as in that vision, seem
> Keeping along it their eternal stands,—
> Caves, pillars, pyramids, the shepherd bands
> That roamed through the young world, the glory extreme
> Of high Sesostris, and that southern beam,
> The laughing queen that caught the world's great hands.
> Then comes a mightier silence stern and strong,
> As of a world left empty of its throng,
> And the void weighs on us; and then we wake,
> And hear the fruitful stream lapsing along
> 'Twixt villages, and think how we shall take
> Our own calm journey on for human sake."

From Khartoum to the sea the Nile falls more than twelve hundred feet, and as the geological strata dip from south to north the higher up the river the older are the rocks. A thousand miles up stream, the cataracts rush through Nubian granite and syenite, while at the lower part of the river, from Cairo to Edfu, the rocks are of nummulitic limestone, so called from the myriads of coin-like shells they contain. The pyramids were built of that limestone. Further up the river than the limestone, but before the granite region is reached, is the Nubian sandstone, which extends into the desert for

thousands of miles. It was from that sandstone the Temples of Upper Egypt were built. Through these rocks the Nile flows at an average rate of three miles an hour. The valley through which it runs varies in width from four to thirty-two miles. Rawlinson estimates the average width of the Nile to be a mile; of the Nile Valley to be seven miles; and the cultivated breadth of the Valley, in consequence of its being flanked with sand from the desert, he thinks does not exceed an average of five miles. In places, the banks are 1,000 feet high, and resemble huge canal embankments.

From the Cataracts to the point just north of Cairo, where its bifurcation begins, the Nile from its earliest history has undergone but little change. Below that point there has been great change. Seven channels are mentioned by ancient writers; and although there are still numerous small streams, there are but two navigable channels, which empty into the sea at Rosetta and Damietta. The old courses have long been dry. From Cairo to the Mediterranean the low flat land through which these channels flow, from its similarity in outline to the fourth letter of the Greek alphabet, is called the Delta of the Nile. Its base is not a straight line, as the shore bulges out into the sea. The extreme points, east and west of the Delta, are about three hundred miles apart, and from the southern apex of the Delta to the sea is about one hundred miles. The point where the river forks is said to have formerly been six miles higher up the stream. The course of the mouths of the great river is continually changing. A fourth part of the Delta is covered with shallow lakes, and the water encroaches towards the west.

The almost unexampled fruitfulness of the Nile Valley is due to the Egyptian climate and to the fertilizing mud left on the fields after the yearly inundations of the river. The tropical rains of Central Africa fall from the middle of May till the middle of September. The Nile, swollen by these rains, continues to rise from June till September, when it remains stationary about a fortnight. In early October, fed by melted snow from the mountains, it rises again for a few days and reaches its highest level, after which it subsides, at first steadily, and then more rapidly, till in January, February and March the fields dry up, and at the beginning of June the river is at its lowest level. At Cairo the average rise of the Nile is 23 or 24 feet, some years it rises 26 feet, and occasionally but 22 feet. In Upper Egypt where the river is narrower the water rises

to a greater height. At Thebes it reaches 36 feet, and at Syene 40 feet. In the Delta, near the sea, the average rise of the water is only about 4 feet. The night of the 17th of June is called "the night of the drop," as according to an old Egyptian myth, a tear of Isis falls into the Nile on that night and causes the river to rise. Astrologers profess to calculate with precision the hour of the fall of the sacred tear. At Cairo, on that night, a multitude throng the bank of the Nile, and numerous old and curious practices are indulged in. From inscriptions found on ancient Nile columns, similar festivals, it appears, were celebrated as early as the 14th century before Christ.

Besides the fertile lands along the river there are five Oases in the desert beyond the Nile Valley that are fruitful. Brugsch says these spots derive their name from the old Egyptian word Wâh, "an inhabited station." Some of these are small, and most of them are thought to owe their fertility to subterranean communication with the Nile. The Fayum is the largest Oasis. It, however, has surface connection with the Nile. It is an oval district comprising 840 square miles, is very fertile, and was the seat of the great temple called the Labyrinth, which Strabo describes, and which Herodotus calls one of the wonders of the world.

The ancient people of this wonderful valley of the Delta, and of the Oases, are said to have numbered eight millions; a greater population than they boast to-day, if the large foreign element in Egypt be included. Modern historians, anthropologists and philologers have worked hard to trace back the history of man beyond the old landmarks, and in some directions their efforts have been crowned with success. Latin authors tell us something concerning the early condition of Britain, France and Germany; and the literature shewing what contributed to the making of these countries daily increases. Schrader, and a score of others, following with untiring patience the clew of language, have plodded their way back to the prehistoric past, and give an interesting picture of early Aryan civilization. We know but little of the aboriginal tribes of this Western world; but Champlain, Charlevoix and the English Voyagers, will set at rest the future enquirer who attempts to follow the wave of civilization, which, in the last two centuries, has resistlessly overspread this continent. But hitherto, attempts to discover the origin and descent of the ancient Egyptians have been futile. The sphinx still refuses to

give up her secret. Ethnologists and philologers do not agree as to the affinities in race and speech of the ancient Egyptians. The linguists maintain that no African race oppressed by tropical heat, has ever developed a civilization like that of Egypt; and that the structure of the Egyptian language is Asiatic, and close akin to the Semitic languages. One philologer points out its analogies to the Aryan tongues. The word *Chami*, 'black,' used by the Egyptians to designate their country in contradistinction to the white sands of the desert, resembles, it is said, the old Indian *syâma*, having the same meaning; and *gupta* or *kopte*, the chief element in the word Egypt, is akin to *gupta*, used as a suffix to *vaisya*, the designation of the Indian agricultural caste. Ethnologists perhaps incline to the views of the Egyptians themselves, who believed they were the offspring of the Gods, and indigenous to the soil. However that may be, it is certain that in the XVIII dynasty Thothmes the third sculptured types of races tributary to his arms; and defined several types of the Asiatic and African races as sharply as they could be portrayed to-day. When the structural affinities of the Egyptian language are thoroughly compared with those of other tongues, clearer light will be thrown on the subject; for if language be not an infallible racial test, it generally decides a nation's ancestry, as fairly as the Ephraimite was detected by his sibboleth, and as Peter the Galilean was bewrayed by his speech.

It is remarkable that Egypt bursts on our view at once as a highly civilized country. Like the fabled goddess who sprang perfect from the brain of Jupiter at her birth, Egyptian civilization first manifests itself at almost its highest pitch of perfection. The reign of Menes, the founder of the 1st dynasty, is placed at about 4000 years before the Christian Era, and only a few hundred years before the building of the great pyramid. But behind him there must be a background of ages of unrecorded growth to bring Egypt to that stage of national life. For our oldest history of Egypt, apart from the monuments and papyri, we are indebted to Alexandria Ptolemy Philadelphus, the second of the Græco-Egyptian Kings, who was a liberal patron of art and literature. He gathered at his court the most famous men of his time. Amongst them was at least one—Euclid the Geometrician—who is better known in the world to-day than he was then. Ptolemy filled the famous Alexandrine Library with the treasures of antiquity, and caused to be

translated into Greek the Septuagint version of the Jewish Scriptures, and a work on the religion and chronicles of Egypt. For that work he secured the services of an Egyptian priest named Manetho, the beloved of Thoth. It was this Chronicle of the Egyptian Kings which the priests of Memphis had permitted Herodotus to see. His works have been lost, one poem perhaps excepted, and the list of the kings as imperfectly transmitted by Josephus, Eusebius, and Julius Africanus. No country has such ancient records as those of Egypt. The monuments were built to defy time, and the papyri and embalmed dead, by the dry climate and desert sands, are hermetically sealed against decay. As Prof. Whitney says: "The oldest writings by man are held by dead hands in the valley of the Nile." But with these advantages there remains a wide gulf between Egyptologists regarding Egyptian chronology. From 1842 till his death in 1884, Lepsius devoted himself to the study of Egyptology, and made a methodical comparison of the lists of Manetho with the ancient monuments and papyri, especially with a papyrus at Turin, which is in fragments from age, and is held in high repute. The chronology adopted by Lepsius has not escaped criticism, although with minor modifications it has been widely adopted. He places the age of Menes, of the First Dynasty, at 3892 B. C., and the end of the XXX Dynasty, the closing reign of the Persian kings, at 345 B. C. The Greek, Roman, Byzantian and Mohammedan periods of Egyptian rule which followed are not in dispute.

Difference of opinion regarding Egyptian chronology has mainly arisen in this way. Some scholars regard the kings given in the list of Manetho as reigning in succession, and take the sum of their collective reigns to be the true time elapsed from the first to the last on the list. Others contend that several of the kings mentioned reigned in different parts of Egypt at the same time, and must be reckoned as contemporaries to rightly compute the time covered by all the dynasties. It is not strange that knowledge concerning Egypt is incomplete, as it was only to the last generation of scholars that Egyptian records ceased to be sealed books. The burning of the Alexandrine libraries and the extinction of the priesthood destroyed the old learning. The written speech of the Egyptians was changed and carried on in Greek characters, with half-a-dozen of the old letters for sounds the Greek alphabet could not express, and, known

as the Coptic, that language survived as a living language amongst a small school of priests until last century.

Egyptian writing is of three kinds, called Hieroglyphic, Hieratic and Demotic. The Hieroglyphics were cut in stone, or, for sacred purposes, depicted in outline on vestments and papyri. They were called by the Greeks *grammata hieroglyphica*—letters sacred sculptured. The two other forms of writing are cursive and quicker methods of conventionally representing the older characters. The Demotic, the younger of the two systems, does not appear in use till the ninth century B. C. From cursory inspection, the monuments and writings were found to shew a variety of Hieroglyphic characters, and closer scrutiny proves that they are even more than was suspected. A Leipzig publishing firm keep in stock for Egyptian printing a font of 1479 different Hieroglyphic signs. They include representations of divinities, men, women, birds, beasts, fishes, insects, and forms of the chief objects before the eyes in Egyptian life.

With such a bewildering variety of signs, it is little wonder that Egyptian writing for centuries was thought to be a form of picture-writing only; and that its characters were supposed to be ideographic and not phonetic. Prof. Mahaffy, in one of his essays, shews, with his usual ability and force of illustration, how transition from the lower form of picture-writing may advance to the suggestion of abstract ideas, by depicted objects of sense; and may further become a conventional alphabet to symbolize sounds, and set in train those faculties of our intellectual and emotional nature, which a clever writer by his pen has the power to excite. It was after a time learned that figurative, ideographic and phonetic signs are all found in hieroglyphic writing. How this discovery was made is an interesting story.

In 1799 a French officer of artillery, when digging a trench in Fort St. Julien, at Rosetta, found a block of black basaltic granite, on which was a trilingual inscription. He was not heedless of his treasure trove, for his General had brought with the army the best artists and *savants* of France, expressly to describe the antiquities of Egypt. Their description filled twenty-two immense folio volumes sold at $1,000. It was the grandest work of its day, and, though in part superseded, remains one of the great books of the world. Nelson rudely awoke Napoleon from his dream of Eastern empire, and after

the army on whom "forty centuries looked down" had retreated, the Rosetta stone was sent in 1802 by Hamilton to England, where it remains in the British Museum. On the face of the stone is inscribed in Greek, in Demotic, and in Hieroglyphic characters, the decree of the priests of Memphis after their coronation of Ptolemy the Illustrious, with the double crown of Upper and Lower Egypt at Memphis, in the temple of Ptah, 200 years B. C. Porson and Heyne made out the Greek text of the inscription, and in 1802 DeSacy, the French Orientalist, and Ackerblade, a Swede, who understood Coptic, analyzed some of the names in the Demotic text. Young, the physicist, best known by his theories concerning light, published in the Transactions of the Antiquarian Society, in 1815, a supposed translation of the Hieroglyphic text. He and Champollion worked simultaneously, though by different methods, but the brilliant Frenchman carried his system beyond the point at which Young rested. Young, however, independently discovered that the cartouches or lines surrounding some of the signs, contained the proper names of Kings. The truth of that had been suspected by Zœga, a Dane. Young's greater discovery was that the figures within those lines represented, not ideas, but sounds. That was the hinge on which the secret turned. Champollion hoped this might some day be found true, yet was not sure but such hope might turn out to be an illusion. In 1814, only a year before, he wrote:—"My "studies day by day strengthen the flattering, though perhaps illu- "sive hope, that from those tablets on which Egypt represented "only material objects, will yet be recovered the sounds of the lan- "guage and the expression of Egyptian thought." Champollion was on the threshold of discovery, but Young was the first to cross into the vestibule of the temple. The credit given to him by Sharpe, the Egyptologist, can hardly be gainsayed:—"It is to this stone, with its "three kinds of letters, and to the skill and industry of Dr. Young, "that we now owe our knowledge of hieroglyphics. The Greeks "and Romans, who might have learned how to read this kind of "writing if they had wished, seem never to have taken the trouble "and it was left for an Englishman to unravel the hidden meaning "after it had been forgotten for thirteen centuries." It was not till December, 17th, 1822, that Champollion read to the Academy his celebrated paper, published under the title of "A letter to M. Dacier." He was an excellent Coptic scholar, and in his later years

was so familiar with the demotic characters that notes for his own use were often written with that alphabet. It is said that some of these notes fell into the hands of a French Academician, who published them as an original Egyptian text of the Antonine period. In his paper at the Academy, he gave readings of many names, and of some other words, and shewed the hieroglyphic alphabet to be phonetic, and in some cases syllabic. On the same night of his reading at the Academy, the discoveries announced in his paper were communicated to Louis XVIII, who, as a mark of esteem, sent Champollion a snuff-box on which was the royal monogram set in diamonds. That was a princely gift; though one he more highly prized came in the words of Chateaubriand: "His discoveries will "have the durability of the immortal monuments he has made "known to us."

All the signs used in Hieroglyphic writing are pictures good or bad of actual objects. A sign may stand alone as a picture to represent the object meant, or it may be placed at the end of a word, which is the phonetic name of an object. Signs are also used figuratively. A circle means the sun; and figuratively it means a day; a vase tilted so that liquid is pouring from it signifies a priest; the ostrich feather means justice, and the leg of a man in a trap means deceit. Another use for signs is as "determinatives." That use is common mostly after proper names. Thus the names of birds are followed by the picture of a bird; of fur bearing animals by a figure shewing a bit of the pelt of an animal and its tail. But in all inscriptions, most of the signs are phonetic, and the sign for each sound is some familiar object. Thus *moulag* is the Egyptian word for owl, and an owl is the sign for the *m* sound, the first sound in the name of that bird. Some signs represent syllables, as the *crux ansata*, the handled cross, in *ankh*, life. Rawlinson says there are at least a hundred signs of this kind. Numbers from one to nine are written with a short vertical stroke for each digit, those from four to nine being written in two rows, one over the other. Occasionally Hieroglyphic writing is found in vertical columns, but it is generally in horizontal lines, to be read from left to right if the signs face to the left, and from right to left if they face to the right; addition of a pointed ellipse, an open mouth means the sign is used phonetically.

The grammatical structure of the language has been partly

unravelled. The article is declined, and substantives and adjectives form their plural by adding an additional letter. Pronouns are used independently, or as suffixes to the verb. The first person of the verb is distinguished by a sign representing the figure of a man speaking. Heine said it was fortunate that the Romans learned Latin in their cradles, for had they learned that language as he did, they could never have found time to conquer the world. Taking into account the number of signs with which this language is written, and that they may be used in a representative, symbolic, determinative, or phonetic sense, and that sounds of the phonetic alphabet have more than one sign, may we not paraphrase Heine's words, and say, had the Egyptians not learned their language in their cradles, they could never have found time to build the pyramids and make their valley the garden of the earth.

The efforts of Young, Champollion and their coadjutors have been followed by success. Starting as they did, and within the lifetime of living men, to examine a dozen signs, which they conjectured might be phonetic symbols of an ancient alphabet, these earnest men were pathfinders who broke the way to a knowledge of the language of one of the oldest and most important of ancient nations. How long Hieroglyphic writing was in use none can say. One of the Oxford museums has a monument, thought to date from the second dynasty. That may admit of doubt, but monuments of the fourth dynasty incontestably shew that this form of writing has existed, at least, for 3000 years before the Christian era. The literature to which that language is the key remains in great part on the walls of Egyptian Temples, Pyramids and Tombs, and on the cerements and papyri buried with the dead. The large number of Egyptian books stored in the museums and libraries of Alexandria, when the Ptolemies made that city the most renowned seat of learning in the ancient world, in successive tumults, were destroyed by Roman, Mohammedan, and, I fear it must be added, by Christian hands.

During the last half century men of ability and learning have devoted their lives to the study of Egyptian history. They have worked assiduously, and have garnered their treasures where they will be safely kept and can be freely studied. Even the Nile mud has had to yield up monuments and cities buried so many ages that their names were forgotten. Some of the shadowy, half mythical,

personages of the older historians, their later brethren by the force of their genius and persistency of their industry, have made as real to us as Julius Cæsar or William the Conqueror. We can follow their actions, call up a mental picture of the world they lived in and pass our judgment on their motives. Their most sacred haunts, the interiors of their temples and mausoleums, shrouded for ages in silence and darkness, have re-echoed to the footstep of the intrusive unhallowed stranger, and have revealed their beauty to the flash of the magnesium wire and the lightning rapidity of modern photography. But it is hard to make the events of a score of centuries march before the mental vision in consecutive course, and harder to describe the development through long ages of the inner and spiritual life of a gifted people. The night of Egyptian darkness was long, and the darkness was a thick darkness, to be felt. The dawn has indeed broken, and we have glimpses of a civilization whose very magnificence almost staggers our belief. But the most skilful historian can give only a faint sketch, with many a broken line, of these long ages, and we can never hope to enjoy as complete a picture of Egypt as Gibbon gives us of declining Imperial Rome.

One striking trait in the character of the Egyptians was their care of their dead. To understand whence that care arose, we must know their views of the constitution of man. Dr. Maspero, an authority on these questions, says the Egyptians regarded every human being as consisting of the body; the *Ka*, or double of the body; the Soul, *Bi*, represented as a hawk with a human head; and the *Khoo*, the "Luminous," a spark from the fire divine. The Dr. further says that the Egyptians also believed, that if left to themselves after death any or all of these component parts of a human being might pass into dissolution, when the man would die a second time, be annihilated. Their piety to their ancestors averted that. Embalming preserved the body, and prayers and offerings saved the other constituent elements of the human being from second death.

In Egypt embalming of the dead was a profession, and the fraternity were so jealous of their rights that the services of the proper functionary of the district had to be secured in each case of death. During the long periods of Egyptian history, new drugs and processes were discovered, but the end aimed at—the preservation of the body from decay—remained the same. The late Dr.

Birch, of the British Museum, says the early embalmers in their practice depended on salt, wax and wine. In the middle empire naphtha and bitumen were used, and later, as the art declined, cheaper substances were relied on. The time of embalming occupied about 70 days, which were spent by the family as days of fasting and mourning. After the antiseptic preparations were finished, a plate on which was engraved the mystical eye was placed on the body; amulets were strung upon the neck; and, as the heart was the seat of life, the sacred scarabæus, with special signs and ceremonies, was placed over the heart. The body was then enwrapped in six or seven hundred yards of linen, on the outer bandage of which a scribe wrote the name of the deceased, sometimes adding his age at death, and the year of the King's reign when death happened, and the mummy was then ready to be encased. The cost of embalming, according to Herodotus, was from $100 to $1,200.

Not the least singular of the charms for adornment of the dead was the sacred beetle, the scarabæus, placed over the region of the heart. In Egyptian its name was *kheper*, a word supposed to be derived from *khepra*, "to become," and it was made the emblem of earthly life and of the changes of man in the life to come. The original of these singular adornments, the common black beetle of Egypt, lays its eggs on the brink of the Nile, surrounds them with dirt, rolls the ball up the steep river bank beyond reach of the inundation, to the edge of the desert, and, leaving them to mature in the heat of the sun to perpetuate its race, dies in peace at its appointed time. This industrious little creature the Egyptian priests choose as their emblem of creative power and of immortality. It was made a hieroglyphic sign, meaning "to be" and "to transform." Miss Edwards says:—"His portrait was multiplied a millionfold, sculptu-"red over the portals of temples, engraved on gems, moulded in "pottery, painted on sarcophagi and the walls of tombs, worn by the "living, buried with the dead."

The scarab is the symbol of duration, and to wear one was a preservative from death. Around this primary idea a thousand conceits clustered, and as charms they were used without limit. Scarabs or conventional representations of them, scaræboids, were cut out of schists and many other materials, and of all sizes. They were glazed and colored in a variety of ways, according to the fashion

of the times. Their study has become a fascinating and instructive branch of Egyptian Archæology. Mr. Petrie, in a volume published a few months ago, gave exquisite drawings of more than 2,300 specimens. He has given only such as bear the names of Kings and private persons; but the best specimens of the great Egyptian Museums are in his book. All the dynasties, and most of the Monarchs of the dynasties, are represented and classified in chronological order. It behooves us not to be altogether heedless of scarabs, for has not Miss Edwards, with great mock gravity, in an appreciative review of Mr. Petrie's book given warning that "Civilized mankind "is divided into those who care for scarabs and those who do not. "The former are a select minority; the latter are dwellers in outer "darkness, and so ignorant that they are even ignorant of their "ignorance."

The same solicitude devoted to the preservation of the dead body was given to its place of sepulture. To the Egyptians the homes of the dead were more important than the homes of the living. A dwelling house for the living was but a resting place which was unimportant, and its structure might be inexpensive and mean. The place of sepulture for the dead was an eternal abode, of superlative importance, and, like the temples of the gods, could not be made too costly or too elegant. Crushed by the tooth of time, and showered over by the sands of the desert, Memphis, the glory of ancient Egypt and seat of her early Kings, so utterly perished that its very place of existence was in dispute, till the shovel of the modern explorer revealed its site beyond doubt. But the tombs of its adjacent necropolis exist in hundreds, and amongst them stands the great pyramid, a marvel of what Egyptian art produced 5,000 years ago, and which in our days of colossal structures, Ferguson, the historian of architecture, says, remains the first building in the world. According to the best Egyptologists, an Egyptian tomb, besides being a resting place for the body, had to include rooms for the soul, which were closed on the day of burial, and which it was sacrilege to afterwards enter; a reception room of the Double, where friends of the deceased and the priest brought their offerings; and a passage connecting the two. The reception room accessible by friends was sometimes above ground. Much variety in tombs, according to the place of burial and station of the deceased, was permissible, but the general features of construction carried out

were the same in all, and every Egyptian, according, to the national beliefs, was theoretically entitled to such an eternal dwelling. But theory and practice, like faith and works, often differ, and the typical Egyptian tomb was virtually for only the wealthier dead. Maspero gives a pathetic picture of the lot of the poor. The funeral rites once over they were disposed of in ransacked tombs, or huddled *en masse* in shallow pits in the sand, and covered only with their bandages or a few palm branches. A pair of sandals of painted card-board or plaited reeds, a staff and a simple ring, the toy image of some favorite god, a mystic eye or scarab, and a cord twisted round one of the limbs to protect from necromancy—such were the funerary trappings of the pauper dead.

The greatest of the Egyptian tombs, the pyramids, have called into existence a literature of their own. More than thirty volumes aim to shew the purpose for which these massive structures were built; and in addition to books, there are magazine articles and pamphlets without number, written to accomplish the same end. The conjectures of these writers are numerous and some of them fanciful. It is contended that the pyramid of Cheops, *Khufu*, the great pyramid, 454 ft. high and 750 ft. wide, divinely reveals a system of weights and measures for the human race, and for all time. Another thinks that they were granaries to provide against famine, and another that they were astronomical observatories. The best Egyptologists, however, stand aloof from such theories. They agree that the 66 pyramids found in Egypt were tombs and were built for no other purpose. The nature of Kings, their souls, bodies, and whole constituent parts, were not supposed to differ from those of other men, and their royal tombs, the pyramids, like other tombs, contain a chapel, passage, and sacred vault. They differ greatly in size, as the smallest is only 30 ft. high, and it is difficult to conceive why the Pharaohs, during the thirteen centuries in which these tombs were built, should have chosen sepulchres of such different proportions.

In constructing their tombs, when space permitted, the chapel was built over the vault, and a shaft connecting the two was sunk, sometimes in front of the tomb door, and sometimes into a corner of of one of its chambers. In instances the chapel was built apart from the tomb, and occasionally at a considerable distance from it. It was into the chapel that on feast days relatives, friends and priests

brought offerings, and placed a repast on the offering table, of which, after the living had departed, the double was supposed to partake. But those recently dead were found to engross most of the attention of the living, and when action was taken, similar to that our forefathers used to take in our own Christian times by establishing foundations to have such ceremonies performed by the priesthood, it only put off a little further the day of forgetfulness and consequent annoyance to the dead, whose double might, it was thought, through such neglect, be reduced to seek food from the garbage of the town. To obviate such a calamity recourse was had to painted and sculptured representations of offerings in lieu of the offerings themselves. At first decorations were confined to the chapel of the tomb, but afterwards on the vaults pictures were painted and passages were inscribed from the Book of the Dead and from other works, intended to strengthen the soul during its probation in the other world. This practice goes back to the time of the early dynasties. The inner walls of some of the pyramids are covered with inscriptions. At a later date such texts were written upon sarcophagi, and on some of the early tombs whole chapters from the Book of the Dead are inscribed. Later on still, in the fifteenth and sixteenth centuries B. C., these books of the dead were written on papyri attached to the person of the mummy, placed between the folds of the bandages, or laid near the coffin.

A fair general view of ancient Egyptian literature may be obtained from the "Records of the Past," a series of volumes published in London and edited by Birch, Renouf, Sayce and other scholars of reputation. The Book of the Dead is, however, the most interesting volume of Egyptian literature as yet discovered. As early as 1805 M. Cadet published "A figured copy of a roll of paper found at Thebes in the tomb of a King," and made some curious speculations concerning its contents. Other copies followed, the chief of which was "*Das Todtenbuch der Ægypter nach dem hieroglyphischen papyrus in Turin, 1842.*" The edition by Lepsius contained 165 chapters, and he was likely the first modern editor who understood the text. Every museum of note in Europe has now a copy of the Book of the Dead, and numerous *fac similes* have been published. But no single papyrus hitherto found contains all the chapters of the book, and the Congress of Orientalists, held at London in 1874, commissioned M. Naville, a distinguished scholar, to prepare a com-

plete text of the whole book. M. Naville confined his attention to MSS. of the time of the XVIII-XX dynasties, and published according to the canons of modern criticism, a text from papyri of that period. After carefully studying 26 papyri of the British Museum, 17 in Paris, 5 in Leyden, 5 in Berlin, and many kept in other museums, as well as the inscriptions at Thebes, his work was published in 1886. It contains 186 chapters, and costs about £12.0.0.

A few months ago the trustees of the British Musuem published in *fac simile* a papyrus of the Book of the Dead. I have pleasure to submit it for the inspection of the Hamilton Association. It was executed for an Egyptian named Ani, a scribe, and director of the granaries of the Lords of Abydos. Like other copies, it does not contain all the chapters, but is illustrated in a finer manner than most other copies are, and the 175th chapter, it is said, has not before been issued in so complete a form. Mr. le Page Renouf has written an able introduction, and gives a full translation of many of the more interesting passages. For reasons assigned at length by Mr. Renouf, the date of the papyrus is referred to about the end of the fourteenth century before Christ. No copy of the Book of the Dead is found on any papyrus before the XVIII. dynasty, although, as has been stated, sculptured passages are found at much earlier date. In the vignettes Ani is accompanied by his wife Tutu. She is called a *kemait*, a musician, or one who belongs to some chapter of a Temple. In her right hand she carries the sistrum, or Egyptian lute, and in her left hand she holds flowers with a symbol to propitiate the Gods.

The aim of the Book of the Dead was to give might to the departed and to aid him in the life after death, but it is hard to trace whatever unity there may be between the chapters, and some of them might be detached from the rest with as little detriment as a hymn can be taken from the Vaidic books, or as one of the Psalms can be read alone without impairment of its beauty. That it records the belief of the Egyptians concerning the common lot after death, reflecting a faith that with little change obtained for centuries, there can be no doubt. The first scene shews Ani and his wife before a table of offerings, and after an invocation to the sun comes the great scene of the psychostasia, or weighing of the heart. There is nothing in the papyrus grander and more impressive than this scene. The heart is weighed against an ostrich feather, which symbolizes law, by

the jackal headed Anubis. Thoth records on his tablet the result of the trial; and the soul of the deceased, destiny, fortune and the cradle, are on one side of the balance as witnesses. To the right is Amemit, the devourer. He has the head of a crocodile, the body of a lion, and the hind quarters of a hippopotamus. After the trial Thoth declares: "The heart of the deceased is weighed and his "soul standeth in evidence for it. His case is straight upon the "great balance." Then the gods proclaim: "Unalterably estab-"lished is that which proceeds from thy mouth. Righteous and just "is he, and without rebuke before us." Other scenes shew Ani before Osiris; and the artist gives a running picture of an Egyptian funeral, with the attending Priests and mourners, till with last adieus the mummy is handed over to Anubis, the god of the tomb.

The deceased then goes forth into the first stages of life in the other world. The Greeks are said to have been taught the doctrine of transmigration by the Egyptians, who believed that when freed from sin by successive transmigrations, a course that might run on for ages, the soul would have the option of returning to its former body, or of being absorbed into the infinite: hence their care to preserve the body. In this papyrus there is depicted the strange conceit of the soul fluttering over a mummy case on its return to the body. It is said of Ani that he may transform himself "into all the forms he pleases;" and many of the chapters refer to such transmigrations and many mystical teachings only imperfectly understood. In the thirty-first scene a second weighing of the heart is described. Whether that is intended to represent a second trial after a stage of further probation in the other world, I cannot say. Plates 31 and 32, in which the second weighing scene is depicted, are remarkable for what is called the Negative Confession. As it is a most interesting exposition of the ethics of ancient Egypt I transcribe it in full. Pleading before his judges, the deceased says:—"I am not a doer of what is wrong, "I am not a plunderer, I am not a robber, I am not a slayer of "men, I do not stint the quantity of corn, I am not a niggard, I do "not seize the property of the gods, I am not a teller of lies, I am "not a monopolizer of food, I am no extortioner, I am not unchaste, "I am not the cause of others' tears, I am not a dissembler, I am "not a doer of violence, I am not of domineering character, I do "not pillage cultivated land, I am not an eavesdropper, I am not a "chatterer, I do not dismiss a case through self-interest, I am not

"obscene, I am not an exciter of alarms, I am not hot in speech, "I do not turn a deaf ear to the words of righteousness, I am not "foul-mouthed, I am not a striker, I am not a quarreler, I do not "revoke my purpose, I do not multiply clamour in reply to words, "I am not evil-minded or a doer of evil, I am not a reviler of the "King, I put no obstructions upon the water, I am not a bawler, "I am not a reviler of the god, I am not fraudulent, I am not "sparing in offerings to the gods, I do not deprive the dead of the "funeral cakes, I do not take away the cakes of the child or pro- "fane the god of my locality, I do not kill sacred animals."

Amongst trials which our traveller in the other world undergoes, he has to pass through a veritable valley of the shadow of death, "for it is all abyss, utter darkness, sheer perplexity." He is also tried by fire, which the artist represents pictorially, but has compensation by a sojourn in the Egyptian Elysian fields, where he ploughs and sows and reaps, and through which runs a canal, "the limit of which cannot be stated," and in which are fish and no serpents. The papyrus ends with a picture of Hathor, a personification of the sky, in the form of a hippopotamus. On her head she holds the solar disk, and in her left hand she holds the symbol of life.

The time has not yet come for a satisfactory exposition of the Egyptian religion; but as some of the acutest intellects in Europe are engaged in its study, we may hope that light will yet shine into the dark places. Their more important gods received homage in different localities under different names. Each canton, or *nome*, had its own college of priests and tutelar divinities, so that we come to regard their religious system, at first sight, as a heterogeneous polytheistic mass. They personified sun, moon and stars, the earth and sky, light and darkness, and, according to Renouf, recognized a divinity wherever they discerned a fixed law either of permanence or change. But behind and above these adored personifications of natural objects and forces there was the recognition of one great power. That admits of no doubt. It is true some incline to believe the *esoteric* doctrine of the Egyptian priests was materialistic; that they held matter to be endowed with intelligent, inherent creative force, and to be eternal. On the other hand many passages from their writings are monotheistic. Referring to the powers higher than the popular divinities, a power to whom no temple was raised, one of

their papyri reads: "He was never graven in stone; his shrine was "never formed with painted figures; he has neither ministrants nor "offerings." And if it be asked what was their name for the great uncreated Creator of all things, Brugsch replies it was inscribed on a scroll which the initiated took to the grave, and which reads "NUK PU NUK," "*I am that I am.*"

CONNECTING LINKS.

Read before the Hamilton Association, February 12th, 1891.

BY H. B. SMALL.

The term "Connecting Links," might perhaps, with more propriety, be expressed under the wider term development, or the state of progression from one phase or class to another.

As an example of this, take the infant and the man. There is little in common between these two stages, save form and existence. But trace the various intermediate stages to see the links of development. The first movements of an infant are automatic and directed solely to the supply of its physical wants. New sensations are constantly excited by surrounding objects, which call into exercise all the dormant powers of mind; notions are acquired of the character and position of external objects. An attachment to persons and places begins to manifest itself. As the child advances in age the power of observation is strengthened, the perceptions become more distinct, the powers of reflection are called out which prompt him to reason upon the causes of what he observes, and his growing intelligence enables him to direct his actions to the attainment of objects he desires.

Then comes a development of moral feeling, and the *intuitive perceptions* of the lower stage of infancy become, through the connecting links recorded, the *acquired perceptions* of the man.

"Man," says Humboldt, "ever connects on from what lies at hand." Progress, degradation, survival, revival and modification, are all modes of the connection that binds together the complex network of civilization. A glance into the trivial details of daily life shows how we are but transmitters and modifiers of the result of long past ages. In the history of firearms, the clumsy wheel-lock, in which a notched steel wheel was turned by a handle against the flint till a spark caught the priming, led to the invention of the flint lock; that in time passed by an obvious modification into the percussion lock, the gun itself now changing again from muzzle-loading to breech-

loading. The mediæval astrolabe passed into the quadrant, discarded in *its* turn by sailors for the sextant; and so on through the history of one art and instrument after another.

Books of costume, showing how one garment grew or shrank by gradual stages and passed into another, illustrate the nature of the change and growth, revival and decay, which go on from year to year in more important matters of life. It is only when we fail to see the line of connection that we form the idea of something having been originated.

There is nothing more evident than the fact that man is in every respect of the same nature as the world in which he dwells, that in fact he is a part of it—a part of the *universal whole;* and, descending from man—the highest known state of organized life down to the animate object of the lowest order—all creation is found to be composed of individual members, which collectively form the infinite whole. The line of demarcation here and there may be rugged; seeming chasms exist, to be bridged over by future revelations of science and investigation—but the conclusive result of all research shows everything to be so gradually and yet so intimately connected that it is in some cases a matter of difficulty to discriminate where one terminates and another begins. All nature may be said to be bound together by a series of connecting links, which conjointly form the chain of unity and point to the grand idea of harmony which pervaded creation at its birth.

Our subject might be extended to all the sciences; to the various branches of learning, including that highest branch of all, mathematics; to music and harmony, or the sweet blending of sounds; to geology; to chemistry; in fact, to everything whose collective parts form unity: but I must to-night limit it to two branches—links of mind, individual and ethnological, and links of matter.

Of the individual links of mind memory stands the foremost; the remembrance of the past, vividly brought before us by some connecting chain of thought, over the links of which the mind bounds at once, till one string so recalls another that the original train of thought is lost, and some past object so prominently recalled that it occupies the attention to the exclusion of all else. Who amongst us to-night, from some chance meeting, from the passage of some well-known author, from the sight of a trifling object, has not recalled scenes and phases of early life and days of childhood long since for-

gotten, and only evoked by some chord of memory being touched. The accidents of life, places, flowers and names, all act as mind links, mementos of the past. A recent writer on "mental physiology," styles memory the "organic registration of the effects of impressions." The character in which organic changes are written may be said to be indelible, and in a brain not disordered, the records of memory are stereotyped. To recall them to consciousness may be beyond our power; we may think they are lost to us forever, till something occurs to alter to an appreciable degree the minute nerve cells of the brain, and thus to tear off the veil which hid from us the thoughts and events of the past.

Dreams are another connecting link, recalling at times long forgotten scenes and faces, memories of bygone times which the storehouse of memory unearths without any apparent reason. If it were possible to trace a dream to its origin, some chance remark, some word or act, not noticed at the time, has touched a chord of memory which continues to vibrate in the nervous state after sleep has sealed the body in repose, till all at once it flashes on the mind, sometimes dimly, like objects in a fog, and forgotten directly, or else so lifelike that it seems to be the cause of the sleeper awaking.

There is another connecting mind link, undefinable, yet plainly manifesting itself, which, for want of a proper term, may be styled sympathetic attraction. I do not mean, by this, biology or mesmeric influence, which themselves seem connecting links, but the mutual reciprocation of mind existing between different individuals, whose unity of thought and intellect run side by side, and whose ideas seem to have been fashioned in the same mould.

Psychology, in itself, would form a subject for a lecture, and I have only introduced the above branches of it as a prelude to the ethnological division of mind links, on which we will dwell at greater length. Foremost amongst these stands Mythology.

There is a striking similarity in the early records or legends of all nations that plainly shows the connecting link that binds together all the races of the human family. Oral tradition, doubtless, had much to do with this. The classic legend of the Golden Age evidently had the same origin as the history of Paradise. The Fall of Man may be traced in the story of Pandora, the first woman, who is represented as having, through curiosity, opened a forbidden box in the house of her husband, Epimetheus. When she raised the lid,

all the evils incidental to man flew out, and only by quickly shutting down the lid did she manage to retain and prevent the escape of Hope. The promise of recovery, through the destruction of the serpent, may be traced in various legends, classical and eastern, where the serpent or dragon is introduced. Hercules slaying the dragon in the garden of the Hesperides, and Apollo killing the python, may have derived their origin from this source. The Persian sacred books, the Zendavesta, contain so similiar an account to our own, of the Fall of Man, that it is generally conceded that Zoroaster, the compiler of them, must have derived it from Moses. Connected doubtless with the Bibical legend of the Fall of Man, serpent worship took its rise, and it seems to have been one of the most universal as well as mysterious superstitions among the primeval religions of the world. The Phœnicians adored this reptile as the genius of beneficent knowledge, the Chinese use it to this hour as a symbol of wisdom, and paint their Kings of Heaven—the Tien Hoangs—with snake bodies. As the sign of the sun, of eternity, and of the art of healing, we encounter the serpent in Arabic, Chaldean and Roman lore. The woman at Endor is called in Scripture, "Ob," that is the serpent; and the name Endor itself, means "the oracle of Ador," who was identical with the Canaanite snake-god Addir. Evoe, again the classic cry of the Moenad priestesses, whose heads were wreathed with snakes, is thought to be derived from Ophis, the Greek word for the creature. At Colchis, at Thebes, at Delphi, we have stories of sacred serpents; the Greeks called Apollo himself "Python," and before the days of the Greeks, the Egyptians carved the asp upon their temples, embalmed it and ornamented the tiara of Isis with it. The priests also wore the reptiles upon their officiating hats; and indeed, Thermuthis, the snake-god of the Nile, amid the sacred figures of the hieroglyphics is everywhere great and revered. The Chaldeans built the snake city of Ophis or Oubis upon the river Tigris. The Æthiopians are thought to derive their name from "Ath-opes," *i. e.*, worshippers of the serpent. Eubœa means "snake island," and one of the earliest heresies of the Christian Church was that of the Ophites. In a word, look where we will, historical vestiges occur of this intense and venerating worship of what we regard as the most base and malignant thing in nature.

Among the Hindoos, the king of evil demons is called the King

of Serpents. Krishna, one of the incarnations of the Deity, attacked the serpent and destroyed it, and Hindoo sculpture represents him with his feet on the serpent's head. Dr. Deane says, in his treatise on serpent worship: "The progress of the sacred serpent from Paradise to Peru is one of the most remarkable phenomena in mythological history, and to be accounted for only on the supposition that a tradition of the serpent in Paradise has been handed down from generation to generation."

Serpent worship existed amongst the mysteries of the ancient Mexicans. There is in the Vatican, I believe, a remarkable painting originally brought from Mexico, representing a woman in conversation with a serpent erect, to which was attached the Mexican legend that the woman was the mother of mankind, and the serpent the genius of evil. The originality of the painting is further borne out by the existence of a colossal sculpture in that country of a serpent swallowing a woman, to which the same legend is attached.

Serpent worship can be distinctly traced throughout all Asia. Living serpents were kept at Babylon as objects of adoration, and to this the apocryphal story of "Bel and the Dragon" points. All through the east is found in the Temples a mystic representation of a circle with wings and a serpent passing through it. This circle, when filled in with a human face, became the "Medusa" of the Greeks. In Hindoostan to the present day, a custom prevails similar to that spoken of in "Bel and the Dragon," when at the "Festival of Serpents," "Kartik Purnima" night, every man sets by a portion of his rice and saucer of milk, which he offers to the snakes around his quarters as a propitiation to them.

Amongst the Scandinavians and Norsemen of old, their deity "Thor," is represented casting down to the bottom of the sea the great serpent Midgard.

Amongst the ancient Druids the serpent was not omitted, as is shown by the serpentine stone Temple of Abury still remaining, and the Saurian mound at Loch Nell, near Oban in Scotland, identical with similar remains discovered in Ohio and Wisconsin. In Ireland its worship was not without its votaries. Ogmius, the chief object of Celtic worship, was depicted with a huge club with serpents twined round it and surmounted with wings like the *caduceus* of Mercury. Dr. Christmas speaking of the serpent worship in Ireland, says: "There is perhaps more truth in the legend of St. Patrick

than is generally allowed. His banishing by prayer all snakes and venomous reptiles from Ireland, may imply that by disseminating the doctrines of Christianity, he overthrew the worship of the serpent and drove its priests from the island."

This form of worship, I believe, is now confined to the inaccessible tribes of Central Africa and an Abysinnian tribe called the Shangallas, and traces of it are said to be met with amongst the lowest class of Negroes in the Southern States, who hold Obi worship once a year in the densest part of the forest and the swamp.

The Hindoos have a tradition evidently connected with the creation of man and the subsequent death of Abel at the hands of Cain. Brahma becoming incarnate, produced the first man out of one half of his body, and the first woman out of the other half. From this pair were born three sons, two of whom quarrelling, one wished the other might be a wanderer on the face of the earth, whereupon, his brother incensed at this slew him with a club whilst performing a sacrifice.

A remarkable legend exists amongst the Iroquois Indians, that the first woman was seduced from her allegiance to God, and on this account banished from Heaven. Afterwards she bore two sons, one of whom, in consequence of a quarrel, took a club and slew the other. But from the same woman sprang many men and women, who were the progenitors of the whole human race.

The fable of Uranus, the first civilizer of men, and his eldest son, Hyperion, being slain by his brethren out of envy, is thought by mythologists to show a connection with the Scriptural account of Abel, whilst some again include under this connection the fable of the Corybantes, three brothers, one of whom was murdered by the other two. Doubtless each legend had its basis in the same origin and from one source.

Take again, as another connecting link of mythology, the deluge. Everywhere the tradition exists, amongst all the Nations of antiquity, amongst the Indians of our own land, the Mexicans, the South Sea Islanders, the Asiatics, and in fact everywhere, and each race has modified or diversified it according to its own ideas. Plato, in his Timæus, gives an Egyptian account of the deluge, on which occasion certain herdsmen and shepherds were saved on the tops of the mountains, but they who dwelt in the plains were swept into the sea by the rising of the waters. In the Hindoo

mythology, the incarnation of Vishnu into a fish, is supposed by Sir Wm. Jones, to bear reference to the deluge. The world having become corrupt and a flood sent to destroy man, the reigning Prince and his family were deemed worthy of preservation, and by command of Vishnu, entered an ark prepared for the occasion called Cahitra. Vishnu took on himself the form of a huge fish, to which the ark was moored by a vast serpent, which being again fastened to the horn of Vishnu, rode securely through the flood.

The Greek and Roman traditions of the deluge are known to every school-boy and do not require mention. The ancient Druidical tradition is handed down through their Bards, as follows: "The profligacy of mankind had provoked the great Supreme to send a pestilential wind upon the earth; a fierce poison descended, every blast was death. At this time the patriarch distinguished for his integrity was shut up, together with his select company, in the enclosure with a strong door. Presently a tempest of fire arose, it split the earth asunder to a great depth. The waves of the sea lifted themselves up around the borders of Britain. The rain poured down, the waters covered the earth and the flood which swept away from the surface of the earth the expiring remains of the patriarch's contemporaries, raised his vessel on high from the ground and bore it safe on the summit of the waves."

The Peruvians had the following account: They believed, by tradition, that it once rained so heavily as to deluge their country. A universal destruction of the human species took place, a few only excepted, who took refuge on the top of a mountain. When the rain ceased they sent out two dogs, which returned covered with mud. After a certain interval they sent out two more dogs, which coming back dry, they concluded the earth was again inhabitable, and leaving the mountains they became the progenitors of the present race of men. The Brazilians have a somewhat similar legend of a man and a woman escaping on a raft. In the Sandwich Islands, all the earth was said to have been covered with water, except one of their mountain peaks, on which one pair of mortals saved themselves from destruction, and from them sprang all the present races.

The Mexican tradition is that a mighty inundation swept from the earth all the generations of man. One man and a woman with their children embarked in a spacious bark, with a great store of provisions, a variety of animals and every sort of grain. In this vast

receptacle they sailed over the deep. At length, when the deities ordered the waters to withdraw, the man sent out a vulture to ascertain the condition of things. This bird, however, feeding on dead flesh, did not return. The man then sent out another messenger, and after dismissing several, the humming-bird alone returned, bearing with it a branch covered with leaves. Perceiving by this that the waters had subsided, the inmates of the bark went forth on Mount Colhuaca. This story is told by Humboldt in his Researches.

In a speech at Birmingham quite recently, Professor Fawcett remarked: "Children who have been taught to read the Bible in an intelligent fashion frequently receive a tacit impression that Jewish history has no point of contact with profane history." But it is very easy to trace, on examination, the connection between many of the heathen gods of the ancients and prominent characters of the Old Testament. For instance, we find Vulcan corresponding with Tubal Cain, Nimrod with Orion, Noah with Deucalion, Moses and the Brazen Serpent with Aesculapius, represented with a stick entwined with snakes, Hercules with Samson, especially in the relation of the former to Omphale, and the latter to Delilah.

The building of the tower of Babel corresponds with the fable of the giants attempting to pile Ossa upon Pelion, and the subsequent confusion and scattering of tongues with the dispersion of the giants. There is a Grecian legend strangely resembling the visit of the two angels to Lot and the subsequent destruction of Sodom. Hermes and Zeus, having visited *incognito* a city on earth, were inhospitably repulsed by the rich and powerful, but were treated with great kindness by an aged couple named Baucis and Philemon, who had retained their virtue when all around were sunk in profligacy. Discovering the divine nature of their visitants from the undiminished quantity and improved quality of the wine in the pitcher out of which they drank, they were about to pay them homage, but were prevented from so doing by the vengeance the deities took on the depraved and inhospitable city. When the old couple, recovering somewhat from their amazement, looked for it, they saw only a stagnant lake, beneath the waters of which the city was plunged. Their cottage was left and changed into a Temple, of which they were appointed Priest and Priestess, and after a long life they were changed into trees overshadowing the structure. Here we see Zeus and Hermes representing the angels, Philemon and Baucis Lot and

his wife, and the change into the trees may be but another version of the change Lot's wife underwent.

A mythological connection has been traced by a French writer, M. Huot, in his *Demonstration Evangelique*, between Bacchus and Moses. Both, he says, were born in Egypt; both were cast into the river; both were educated in Arabia, or resided a considerable time there; both were exiled; Bacchus was ever accompained by a dog, and the companion of Moses was Caleb, the Hebrew word for dog; therefore, says Dr. Huot, the identity is sufficiently proved.

Many other coinciding characters could be adduced if it were necessary to show the connecting links of mythology with Scriptural traditions.

It is interesting to trace in the various forms of religion, or modes of worship, the connecting link which pervades all, from the rudest form up to enlightened Christianity. The rites of sacrifice, purification and a future life pervade all. The Red Indian believes in his Happy Hunting-grounds; the South Sea Islander in his shadowy Island of Bolotu; for the Greeks of old were the Elysian Fields and Hades; and to the Christian of to-day, the heights of Heaven and the depths of Hell hold forth an expectation of a life to come. A child naturally wonders why the Israelites formed and worshipped a golden calf, when they thought Moses had forsaken them, but it was simply the remembrance of the god form they had seen worshipped in Egypt that suggested it to them. The rites attendant on the Obi worship of the Negroes of the present day, and those attendant on the worship of Astarte and Mylitta, and the later Eleusinian mysteries, are closely allied. Success would never attend a new religion about to be thrust upon the world, without adapting it to the forms of something preceding it, and thus we find each successive form of worship gradually adopting certain practices of the one it was intended to supplant, but showing by these the connecting link pervading all.

Sabaism, or the adoration of the sun, moon and stars, branching off into fire worship, is easily accounted for as a degraded form of that homage to visible Divinity, with which men worshipped the glorious god of day, and bowed down before the heavenly host. It was alluded to by Moses when he said: "Take heed to yourselves, for ye saw no manner of similitude on the day that the Lord spake unto you in Horeb, out of the midst of the fire * * * lest thou

lift up thine eyes unto Heaven, and when thou seest the sun and the moon and the stars, even all the host of Heaven, then shouldst thou be driven to worship them."

Amongst the Medes and Persians of old, fire was worshipped as the element containing and diffusing light, and in special places a perpetual fire was kept up, with certain purifications and ceremonies. The material worship of light and fire was raised in the religion of Ormuzd, their divine being, to a spiritual character, the symbol of higher spiritual purity. For a long period worship was paid simply to the light and fire, as they appeared in nature; the imaginations of the Persians do not seem to have conceived the objects of their worship in definite forms, nor did they invent any mythological stories about them. Sacrifices were offered in the open air and on hills or high places, and Herodotus expressly states that the Persians, in his time, had neither statues nor temples. Idolatry was afterwards introduced but soon disappeared, and its place again supplied by the material worship of fire, and at this stage the religion of Ormuzd has continued to the present day, for the few surviving remnants of the ancient Iranians, called Parsees, still cling to the worship of their ancestors, notwithstanding the furious persecution of the Mohammedans. They are found in some of the eastern parts of Iran, especially in Surate, in Western India, and amongst the Afghans, but their religion has become a coarse mechanical and superstitious fire worship.

Used more or less by all the nations of antiquity, especially of Asia, it was likewise the religious form of worship amongst the Aztecs and Peruvians of this continent, and traces of it yet linger in some of the Indian festivals of the west. Amongst the Aztecs, at the end of every 52nd year, their cycle, a high religious festival in honor of the sun was held, on the eve of which every fire was extinguished, and after an interval of fasting, the ceremony of the new fire was celebrated, the Priests going at midnight to a neighboring mountain, where by means of friction the sacred flame was rekindled, which was to light up the national fires for another cycle. As the sacred flame again blazed on the high altar and was distributed to other shrines, shouts of triumph resounded and a festival lasting 13 days was held, attended with human sacrifices—a sort of jubilee for the recovered flame, type of a regenerated world. Dr. Wilson, in his description of this Aztec ceremony compares it to the Annual

Miracle of the Greek Church in the crypt of the Holy Sepulchre.

Amongst the Peruvians a feast was held at the Summer Solstice, for three days previous to which a solemn fast was held, the fire on the great Altar of the Sun was allowed to go out and no private fire was kindled. On the fourth day, after various rites of adoration, the sun's rays were collected by a priest into a focus by means of a concave mirror, by which a heap of dried cotton was ignited and the Sacred Fire again rekindled direct from the sun. Only when the sky was overcast was friction resorted to by them, but such an event was looked upon to be almost as calamitous as the extinction of the Sacred Fire, which it was the duty of the Virgins of the Sun to guard. Here again can be traced a link connecting with the Vestal Virgins of early Rome.

Amongst some of the Indian tribes traces of the Annual Festival of Fire are discernible in their New Year's Dog Feast, extending over six days, during which two "Keepers of the Faith" visit each Lodge and perform the ceremony of stirring the ashes on the hearth, accompanied with thanksgiving to the Great Spirit. On the fifth day a fire is solemnly kindled by friction, and on it at sunrise is sacrificed a white dog as a propitiation to Manitou. Traces of Fire and Sun worship still linger in Europe, in the Beltan fires of Ireland and the Channel Islands on St. John's Eve, the Summer Solstice, in the Easter Bonfires of Germany, the Yule Log of Xmas, the Winter Solstice, and in the peasant of Saxony and Brandenburg climbing the hill-tops on Easter morning to see the sun rise, whilst it is also thought that the hymn or carol sung by chorister boys in the tower of Magdalen College, Oxford, at sunrise on May-day, is but a remnant of the adoration of the sun handed down by the Druids.

The monumental records of antiquity, in the form of cromlechs, pillars of stone, obelisks and sculptured stones, are a link that enables the Archæologist to trace the connection of early nations and point to Asia as the cradle of the human race.

Dr. Wise, in a paper read before the Royal Society of Edinburgh, in 1855, ably demonstrates the general identity of the ancient monuments of S. and W. Europe with those of Hindostan, proving it by the physical conformation of the races who inhabit those widely distant countries, by the similarity of many of their manners, customs and observances, and by the decided and extensive affinities

of the Celtic and other languages of W. Europe with the Sanscrit, which afford as strong an evidence as we can be expected to obtain of a connection so remote between races so widely separated. Dr. Wise says that the names of mountains, rivers and other great natural features of the south and west of Europe, bear evidences of its having been in the possession of a Celtic race anterior to the earliest date of authentic history, and this early connection indicates a line of enquiry by which much of the obscurity resting over the earliest monuments and history of Europe may be cleared away. May not the same test be applied to the monumental records of the race long passed away on this continent, prior to the Indian, known to us as the "Mound Builders," and whose cyclopean works have survived in the ruined cities of Central America, and are regarded by even the native tribes there, with such superstitious awe that they avoid frequenting them in any way? Some of these mounds and stone records, along their line of advance southward, bear a striking resemblance to the Druidical circles, and would thus point to one common origin.

Dr. Wise says the general identity in idea and design of the European monuments with those of Hindostan, is so marked as to justify the inference that races of Asiatics proceeded westward at different ages, and established themselves along the shores of the Baltic and Mediterranean, and part of the Atlantic coast, along which they have left characteristic monuments, which resemble those of their original country. These races appear to have proceeded westward by Scythia and Scandinavia on the one hand, and by the shores of the Mediterranean on the other. We find the same cromlechs and pillar stones in Circassia, Tartary, Asia Minor, Sardinia, the Atlantic shores of Spain, Gaul and the British Isles. May not another exodus have taken place eastward from Asia across the Behring Straits to the American Continent, and proceeded southwards along the line of mounds which remain as landmarks of their route, and which may become, in the hands of Archæologists, connecting links to prove the identity of their builders with a Hindoo ancestry, just as the sun worship of Peru and Mexico, which I have described, is a remnant and the connecting link with the fire worship of Assyria, Chaldea and Persia, and of the rites of Moloch and Baal? In connection with this, Dr. Wilson says in his "Prehistoric Man," the worship of the Sun, though associated with ancient rites of

Asiatic nations, is not *necessarily* an evidence of the eastern origin of the nations of the New World. But in the services to which it gave rise, we have at least suggestive hints of the links that bind together its ancient and modern tribes; perhaps, also, they may supply a clue to the interpretation of some of the obscure sculptures, with their mysterious hieroglyphics, still remaining on sites of the extinct native civilization of America, and of rites once practised amid the sacred enclosures, and on the altar mounds which give such peculiar interest to the river terraces of the Mississippi Valley.

In tracing the personification of the deities of old, the link that connected such personification with the ideas of the instituters of Heathen worship is easily distinguishable. In the early days of Greece, for instance, the division of the deities contained only those emblematic of the forms, properties and powers of nature, and next the impersonation of the qualities of the mind. The first were the natural result of the awe that filled the mind when it observed the mysterious changes perpetually going on in the world around, the apparent agency of something giving fertility to the earth and motion to the wind and sea. The dogma of that was "*Jupiter est quodcunque vides.*" And of this deification of the all, the deification of the parts was a natural consequence. Pantheism led to Polytheism. So the powers of nature were worshipped under various forms and with various rites, consonant to their supposed attributes, and the idea of the *existence* of such beings was so brought to the minds of the people that at length representations of these unseen agents, fashioned as the mind would naturally personify them, were made.

As years rolled on and man passed from the contemplation of material forms to that of spiritual phenomena, and when the principles of social existence began to be understood, then it became necessary to typify the qualities of the mind. To this we may trace Apollo, the patron of learning; Minerva, the legend of whose birth typified a blending together of the characteristic influence of the sexes, masculine strength and female beauty. And so could we trace one by one the attributes that connected each deity with the form assigned to it, the connecting link in the mind of that cultured race that coupled the ideal with the character and propensities of the time.

Language is another of the connecting links of nations.

I think it was Dante who makes Adam enunciate the notion that there is no primitive language of man to be found existing upon earth, but the connecting links of language which can be traced in the words of all nations are so palpable that they plainly point to one common origin. To trace these affinities, however, would of itself fill a volume, and I shall only allude to one or two peculiar ones.

Philologists trace a remarkable connection as subsisting between the modern languages of Europe and the ancient dead languages of the Indian Vedas, thereby tracing the origin of the human race to some probably Asiatic centre.

Throughout the Polynesian Archipelago there are connecting links of language in each Island, showing all the different islanders to be the descendants of one common race. Even in Madagascar are recognized certain Malay and Polynesian words. Important elements of relationship are stated by linguists to be traceable between the native languages of South America and those of the Polynesian family, which suggest a peopling of that part of the continent from Asia through the Islands of the Pacific, and Garnett goes even so far as to show an analogy between them and the languages of Southern India. This subject is largely entered into in the proceedings of the Philological Society, and is too extended except for passing allusion here. The study of the affinity of languages is now leading philologists to anticipate important revelations as to the links connecting the tribes and nations of mankind till they are traced to one original centre, and a determination of the probable lapse of time requisite for the formation of the various sub-divisions now existing.

Writing has also its connecting links. Picture-writing, or the literal figuring of the objects designed to be expressed, merged into the Egyptian hieroglphics, which, through a natural series of progressive stages, were developed into a phonetic alphabet, the symbols of sounds of the voice. The Indian of to-day, on the far off prairies of the west, chronicles his deeds on the skin side of his buffalo robe and on his birch bark, precisely as his ancestors, centuries ago, painted on the rocks, and this picture-writing, when understood, is remarkably figurative.

In the history of the Indian tribes of the United States, mention is made of a census roll of a band of Chippawas, in Minnesota,

numbering 108 souls, each depicted by a different object, with a series of units simple as those on the Rosetta stone, denoting the numbers of each family, and as intelligible, it is said, to the Indian Agent, as our figures and writing. The object chosen to distinguish a family bears a strange similarity to the crests and heraldic devices of civilized nations.

Humboldt assigns one of the traces of the Asiatic origin of the early races of America, to the connecting link in the symbolic character of their numerals. The four symbols of the seasons among the Aztecs, corresponded precisely with those of the Chinese, Japanese and other Asiatic nations. The Peruvians transmitted to future generations a record of events on a cord of different colored strings, to which others were attached of various colors; yellow, denoting gold and all its allied ideas; white, silver or peace; red, war or soldiers; green, agriculture, and so on. These strings were called a *Quipu*, and a corresponding link to this is to-day to be found among the Indians, in the form of the Wampum belt, used by them for registering their events, and given and received at their treaties as the seal of friendship.

Time will not permit us to dwell longer on ethnological connecting links, and we will now pass on to those of matter, or to speak more plainly, natural history.

It was a remark of Linnæus, that nature takes no leaps, she proceeds by insensible transitions. Mr. Bennett, a rising naturalist, in England, in an article in the Popular Science Review, says: "Classification is now but a human contrivance for tabulating the links in the endless chain which connects all living things." The lines on the chessboard have disappeared and have given place to the imperceptible gradations of the colors of the rainbow. While we can still define red and yellow and distinguish one from the other, we must admit a wide debatable borderland of orange. Even the division of animate nature into the two kingdoms of animal and vegetable life is no longer unchallenged. The last refuge of those who still maintained the essential distinction of the two kingdoms, viz: that the food of animals is organic, whilst that of plants is inorganic, must now be abandoned, and carnivorous or insect-devouring plants hold the position of the connecting link which has hitherto been considered wanting. These plants alluded to in Dr. Hooker's inaugural address before the British Association

in 1874 have been experimented upon in various ways, and the result shows that they absorb through the tissue of the leaf by special organs the material required for their food, and the actual agent in the digestion of insects is a ferment of nature similar to pepsin, which is secreted only during the absorption of some digestible substance. Insects steeped in lithium have been placed on these carnivorous plants, and the roots, when boiled some 30 hours afterwards, afford the colouring matter of the lithium, showing that it has been absorbed and distributed throughout the whole plant tissue.

Up to the year 1837, the efforts of naturalists were chiefly directed towards the perception of differences and the creation of species. But in that year Schleiden told the world, after long research, that as the lowliest members of the vegetable kingdom are each in themselves an individual cell having life and activity, so the highest orders of plants were only congeries of such individuals moulded into a thousand shapes and adapted to different purposes. He enunciated the principle that the story of a plant is to be studied through the vital history of its composing cell elements, and proclaiming the microscopic vegetable cell as the unit of vegetable creation, he exalted it to a place of honor—the key to the cabinet of Vegetable Physiology.

His researches induced Schwaun to apply to the animal world, the same method of enquiry which Schleiden had inaugurated among plants, and he in his turn made known the sublime truth that the law of formation and reproduction which prevails in the vegetable, rules also over the animal creation—the scheme is the same, the cell the element of being. Bones, cartilages, muscles, nerves and every tissue were traced to their origin in cell growth, the universality of which binds all created beings in one sublime connection and proclaims a common law of growth. The vital processes of the body are carried on by cell action; secretion, absorption, exhalation, nutrition, chemical change and vital change, all indicate only phases in the history of cell life—that epitome of all organic life. But while Schleiden and Schwaun were working amidst the mysteries of structure, Professor Owen took up the question, and what the former had done for structural anatomy, Owen did for the anatomy of form. The man, the bird, the reptile, the fish, the saurian and the monsters of pre-adamite earth seemed to be sepa-

rated by as wide an interval as the lichen from the palm tree. But the secret once fathomed and the type established, their visible connection is read off plain. Owen has satisfactorily demonstrated that by changes of one form alone, the archetypal vertebra, all varieties have been effected, yet all are connected. Some idea of the infinity of life may be formed by a comparsion between the microscopic animal, which, when magnified 5,000 times, only appears the size of a visible point, and the huge form of the whale, measuring something like 100 feet; yet all the intermediate space is filled up with animated beings of every form and order, more or less connected; or in the vegetable kingdom by comparing the microscopic mildew with the giant trees of California, and yet knowing that the immense interval is filled with plants, shrubs and trees of every form and size.

One mark of the connecting link of animal life exists in what are known amongst naturalists as rudimentary structures. There is discoverable in all vertebrate animals a general type amidst the diversity of form; there are undeveloped limbs or members which are of no use to the particular animals in which they are found. Apparently functionless and useless where they occur, but representing similar parts of large size and functional importance in other animals, they seem to serve no other purpose than to prevent the gaps in the scale of nature being too large. As examples of these rudimentary structures, I will mention a few: The Rorqual, a species of whale has rounded horny filaments in its jaws, united by a common membrane, in addition to the balaena or whalebone, these filaments apparently corresponding to the teeth of the spermaceti whale. The foetal teeth of the common whale, and of the front part of the jaw of ruminating animals, are minute in size and never cut the gum, but are absorbed without ever coming into use, and no other teeth succeed them or represent them in the adult condition of those animals. The Ornithorhyncus of Australia possessing no teeth, has a horny appendage on each side of either mandible, but without roots, evidently corresponding to teeth in other animals. The Apteryx, a New Zealand bird, utterly incapable of flight, has an almost imperceptible wing in quite a rudimentary condition, yet it contains bones which are miniature representatives of the ordinary wingbones of birds of flight. In the Emu the wings are discernible, and in the Ostrich they become largely developed, although useless as wings proper. The Anacondas and Boas, the largest known

species of serpents, have beneath their scaly coats two elementary extremities, rudiments of the organs of locomotion, just anterior to the base of the tail, and in which are found a series of bones representing those of the hind limbs of Mammals. These rudiments, though imperfectly developed, are yet acted upon by powerful muscles, and thus become a strong fulcrum in the animals' movements or in seizing their prey. We may pass from lizards to serpents through a continuous series of forms in which the limbs become more and more feeble, until all external traces of them are lost. Such, for instance, are the family of Chalcidae, one of which, the Pseudopus, found in Northern Africa and Greece, has only the rudiments of hind limbs; whilst another, the Chirotes, a native of Mexico, has only the fore limbs, placed a short distance behind the head, yet so developed in its case as to be used. In the family of Scincidae, the Evesia, a native of India, has the limbs reduced to footless appendages. In the common slow worm or blind worm, rudimentary limbs are found beneath the skin on dissection.

In a species of Turtle, the *Matamata*, found in Guiana, rudimentary ears or ear-like membraneous prolongations of skin on the head exist. Again, at the inner corner of the human eye is a third eyelid, known, I have no doubt, to very few persons, and an object of attention only to anatomists. In other animals, birds especially, it is of full size and of great utility, enabling them to turn their eyes upwards to the sun, a feat they could never accomplish were not the visual organ thus protected.

A curious animal has been discovered in the Amazon, called the Lepidosiren, with the scales and mucous covering of a fish, but with rudimentary limbs, represented by four tentacular appendages, not jointed. Another species is met with in South Africa, with the tentaculae jointed.

Professor Owen, speaking of rudimentary forms, thinks that we have not in this globe all the diversities of which a general pattern or archetype is susceptible, and that limbs which are found only in an undeveloped state in this world, may be fully developed in the other planetary bodies. Arguing on this principle, Dr. Leitch, in his work. "God's Glory in the Heavens," says there are undeveloped volcanic structures on the face of the earth, similar ones to which have long ago been fully developed in the moon, and by analogy he

shows a connection between the geological formation of the earth and that of its Satellite.

Although in the more recent geological formations, there are numerous fossils met with corresponding to similar living species, few, very few, are the existing types or links connecting the present with the earlier geological periods. The few that occur to me I will allude to. The "Gar-pike," or Bill-fish of our Canadian waters, comparatively rare here, but abundant in the West, helmeted and mailed in almost impenetrable scale armor, with its jaws hinged similar to the Alligator, and its vertebræ of the regular ball and socket formation, points to a close affinity with the Saurians and the fossil Ganoids of Agassiz. The Trilobites have long since ceased to exist, but in the Antarctic Ocean science has brought to light a curious crustacean, (Glyptonotus Antarcticus), which strongly recalls the extinct form of the Trilobite. The Crinoids and Encrinites of the Palæozcic world, have a link remaining extant in the pentacrinus of the Caribbean Sea, with its delicate strong stem, bearing on its summit a symmetrical cup or body, around the margin of which are supported five strong arms, which ramify into scores of fingers. The whole structure is composed of thousands of little stony pieces, fitted together with mathematical precision. The fossil plants of our coal measures have their existing links in the arborescent ferns of Australia, the lowly club moss of our own woods and the diminutive equisetum of our swamps, and the tangled thickets of tropical morasses; but the majority of the early forms of creation, having fulfilled their work have passed away, leaving no existing type or link to be associated with their story record in the rocks.

There are many apparent connections between animal and vegetable life, or between different orders of *animals* which are apt to mislead a novice from their similarity to a transition state. Such, for instance, is the Sea Anemone, presenting all the colors, hues and appearance of the flower of that name, though belonging in reality to the animal kingdom. The same remark applies to the Sponge, which, though apparently growing at the bottom of the sea like a plant, is now acknowledged to be of animal growth and allied to the coral builder. The Ornithorhyncus of Australia, an animal possessed of the bill of the duck, and with webbed feet, is not a connecting link as once was thought between beasts and birds, although possessing certain properties of both. That the Armadillo is a link

between animals and reptiles, viz: the Tortoise which it somewhat resembles, is another popular error, for the Armadillo has a coat of mail, implanted as it were on the skin, whilst the shell of the Tortoise is part of the skeleton extended, and as it were thrown outside the body for the protection of the internal organs. The Bat, ignorantly asserted by many to be a connecting link between birds and mammals, belongs exclusively to the latter as much as the so-called flying squirrel, and the flying fish has acquired that name only from the impetus it gains by its fins in leaping out of the water when pursued by larger fish, the fins not being used as wings at all.

Errors like these have to be guarded against by the student of Natural History, and, where possible, nothing should be taken for granted without examination.

Turning to the vegetable kingdom we find the mutual relations of the parts of the flower and their homology with the leaves indicated by those cases in which there is a gradational passage from the leaf to the bract, from the bract to the sepal, from that to the petal, and from the petal to the stamen. The non-development of some organ possessed by neighboring groups is manifested by the presence of that organ in a rudimentary or undeveloped condition. When the whorl, or part of it, in a flower is suppressed, the deficiency is manifested either by the presence of the undeveloped organs in rudimentary form, or by leaving a space for them in the arrangements of the parts which are present. Thus, in the Primrose tribe, there is a single row of stamens opposite to the petals, instead of alternately with them, according to the regular plan of floral development, from which the botanist concludes that a whorl has been suppressed, which ought to intervene between the petals and stamens. The rudiments of an intermediate row are found in the *Samotus* in the form of a whorl of little scales, not developed into stamens. In the common Sage, only two stamens are found where the plan of the flower would lead us to expect five; but on looking at the interior of the corolla attentively, two little scales may be seen where the two deficient stamens should have been. These scales are frequently developed as perfect stamens in flowers, which otherwise are constructed precisely like the Sage.

In botany, however, the term transition might more appropriately be used than connecting links. The Algae, or water weeds, vegetate exclusively in water or damp situations. Their nearest representa-

tive on land is the lichen, growing on rocks, trunks of trees and other hard substances, and deriving its nourishment from the atmosphere. Some of these approximate to the Algae, some to the Fungi, and whilst some botanists rank them with one, and some with the other, it seems reasonable to regard them as an intermediate section —a connecting link. Next come the Liverworts, Mosses and Ferns, passing so gradually from one to the other that the connection is apparent to all when closely examined. For instance, the Liverwort begins to assume the structure and aspect of a leaf, and has an indication of a central midrib; Moss has a distinct axis of growth more or less erect, in which the elongated cells seem to prefigure the wood of plants. There is no actual root, but radical appendages are put forth from every portion of the lower part of the axis, and even from the under surface of the leaves. The Mosses, known as Stag's Horn, Club Moss and Tree Moss, closely assimilate to the lower forms of the Ferns from which they are hardly distinguishable. The Tree Fern possesses a stem round which leaves are symmetrically arranged, and has a proper descending root; in the case of some of the Fern tribe, particular fronds manifest themselves from the rest of the leaves as fertile or spore-producing. In this departure is seen the tendency towards a flowering plant, which the next class in succession, the Equisetum, fairly merges into. From that upwards there is no difficulty in tracing the gradation which connects in the end the mightiest monarch of the forest with the tiny growth of vegetable mould, discernible only under the microscope.

In the early part of this lecture I spoke of man as the highest known state of organized life. Whether he is a connecting link with a higher race of beings is not known, but this much we do know, that though in structure and functions he ranks as belonging to this sphere, yet by his intellect and reasoning powers he approaches those chosen creatures who are represented as shining near the Throne of the Eternal and form a bond of union between heaven and earth. By the exercise of his genius man elevates himself towards that Supreme Being in whose likeness he was fashioned; by giving scope to his passions, he debases himself to the lower orders of life to which he is akin.

Having now cursorily traced connecting links as they may be seen in our daily intercourse with nature and in our study of history, it remains for me only to allude to the great final connecting link,

which, if I may so use the term, is miscalled death—the connecting link between this and a future state of existence. A recent writer in a scientific journal says: "On earth we have no veritable death, we have only change of form and condition." What we call a dead body is not dead—an Egyptian mummy even tries hard to attain a real death in vain, but it corrupts, it decays. Corruption is a force—a potent agent, the harbinger of life to come. Assimilated with the elements of which it was composed, the organic matter of a dead body is absorbed and reproduced, we cannot tell when or where, for one form of matter is continually taking the place of another in everything. Animal and vegetable remains are changed, and again become part of the earth of which they were composed. During life the body is continually changing; death is only a loss of consciousness and a cessation of action in the intellectual and sentient being; it is not a loss of existence, for not a particle of matter ever ceases to exist, but it is the change—the transition state—which the body must undergo previous to its being created anew into other forms of existence. I speak here simply from a scientific view apart from a doctrinal one; the future of the soul is a subject for other hands and another place than this, but even of that future, death is still a connecting link between the sphere we now inhabit and some other region far away, of which the mind of man can form no conception.

The idea of looking on death as only a change, is thus beautifully expressed by Lord Lytton:

"There is no death; the dust we tread
Shall change beneath the summer showers
To golden grain or mellow fruit
Or rainbow tinted flowers.
There is no death; an Angel form
Walks o'er the earth with silent tread,
He bears our best loved things away,
And then we call them dead.
He leaves our hearts all desolate,
He plucks our fairest, sweetest flowers;
Transplanted into bliss, they now
Adorn immortal bowers.
Born to that undying life,
They leave us but to come again,
With joy we welcome them the same,
Except their sin and pain;

And ever near us, though unseen,
The dear immortal spirits tread,
For all the boundless universe is life—
There are no dead."

FLUTES OF THE TIME OF MOSES, RECENTLY DISCOVERED IN EGYPT.

Read before the Hamilton Association, March 12th, 1891.

BY J. E. P. ALDOUS, B. A.

The importance from an historical point of view of the recent discoveries in Egypt must be my excuse for bringing this musical topic before an audience that is not composed entirely of musicians. Within the last few months discoveries have been made that carry back our authentic information one thousand years earlier than it went at the beginning of last year, and I think I can make this clear to any one who has the reasoning faculty, musical or otherwise.

Let me commence with a short and very condensed statement of some scientific musical facts, which it is necessary to understand in order to appreciate the value of the discoveries.

Tone, or musical sound, is the effect on the brain of pulsations of the air at regular intervals striking the drum of the ear. The pulsations of the air are started in various ways. If a stretched string is plucked it will give a certain note ; if it is stopped or held at the half of its length each half will give vibrations twice as quick, or in other words will sound an octave higher. You can easily understand that between the end of the string and the halfway point there are an infinity of points where you could "stop" it, each stop making the pitch a shade higher till the octave is reached.

These "stops" (or steps we might call them) are of the utmost importance, for music is dependent on the number of steps in the octave. Modern music, by which I mean music as we find it in Europe, America and all parts of the world, colonized from these sources (the only music worth calling music), is built on a system of steps of such size that there are twelve of them in each octave. These twelve are called half-steps, or semitones, which latter term would imply another arrangement of the steps that I must allude to. If you sound these twelve half-steps in the octave, one after another, you get no idea whatever of *tonality*, which means a relationship of

the various steps to one particular step as their starting point, or "key note," as we call it. But if we take a selection from these steps, in what may seem at first sight an arbitrary manner, we get what is called a scale.

If, starting from the first tone or open string, we skip the first small step and take the next, we shall get the interval known as a whole step or whole tone. Let us do the same again. Let us next take a small step: we have now a group of four notes at unequal intervals, two whole steps and one half. Let us now take a large step from the top one of these four, and from that, as a starting point, make a succession similar to the first four, which will bring us to the octave. I am stating all this to make clear to you that music as we know it is based on a succession of tones and semitones (steps and half steps) in a certain order, the half steps being of such a size as that it takes twelve to complete the octave.

Some Asiatic tribes to-day, and some semicultivated races elsewhere, make music from stringed instruments in which they use steps smaller than ours, in some cases making eighteen and more steps in the octave. This may be music to their ears but it is not such to ours.

Concerning the history of our modern scale, it is a development of the Greek system. The first Greek lyres had only four strings, which were tuned in certain successions of steps and half steps according to the mode in which the music was to be played. We learn from Greek records that the philosopher, Pythagoras, visited Egypt about 600 B. C. and got from that place the complete octave scale; but that was the utmost we knew about Egyptian music. What their theories were, how long they had been known, was all mystery and speculation. We saw their harps of many strings, their flutes and double flutes all portrayed in painting and sculpture. A few shreds of reed-pipes and rickety remains that could scarcely be looked at without falling to pieces, tantalized us with the "what might have been" or "used to be." But guess work is now ended.

Near an imposing pyramid, built by Usertesen II, a monarch of the twelfth dynasty, who reigned some 4,500 years ago, at the entrance of the Nile into the Fayum province, and about 60 miles south of Cairo, stood the town of Kahun, which was built for the habitation of the architects and workmen employed in the construction of the pyramid. It would seem that when the building of

the Usertesen pyramid was completed, the workmen's colony was naturally dispersed, and so Kahun became gradually deserted. Some few inhabitants lingered on till the eighteenth dynasty, when the town was finally abandoned. But previous to this the rock cellar tomb where our wonders were discovered had been used as a sepulchre.

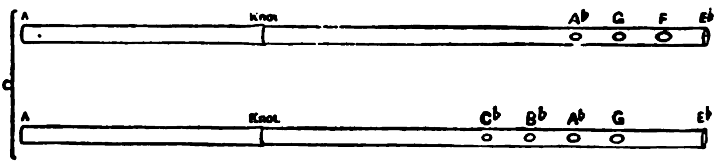
Mr. Petrie, the Egyptian discoverer, is of the opinion that at the end of the nineteenth or early in the twentieth dynasty, (about 1100 B. C.,) the tomb was rifled and again used as a place of burial by some new comers in search of a sepulchre for their family. As was common, the later people plundered the early mummies, decorating their own dead with the spoils. From that period until Mr. Petrie broke into the cellar the place had been undisturbed. The light of day had not entered since the time of Moses, some 3000 years.

Several coffins were deposited in the vault, the mummies being in a very decayed state, and much of the wood-work found was in the same condition. Among the articles found here are some exquisite specimens of the jeweller's, potter's and lapidary's art. Not the least interesting is a large chair of black wood, perfect except the seating and the front legs, which the custom was to break off before entombment: this was done to prevent it being again used, and in order that the ghost of the chair should duly accompany its owner to the other world for future service.

In the rich and varied collection gathered by Mr. Petrie in his investigations, the whole life of the people is brought before our eyes, from the toys of the children, through their every-day life, down to their death and embalming. We seem to be dwelling in Egypt and observing the daily life and customs of this old, old race. There are many things shown which make us, living in this nineteenth century after Christ, with all its wonders and inventions, feel astonishment at the knowledge and practice of the Egyptians who lived 1500 years before Christ. Amongst other marvels of Mr. Petrie's collection may be mentioned a delicately wrought lady's hand-mirror, ornamental beads for embroidery so small that one wonders how they could be made—93 only weigh a grain, papyri dating from the time of Abraham, hinges that interlock, and an incubator for hatching eggs.

The tomb contained twelve large wooden coffins, all the mummies having been badly embalmed. The best preserved of the

series was that of a lady bearing the name of Maket. Her name was engraved on a gold scarab, on a small silver one set in a ring, and on another ring. Her coffin also contained the lady's bead necklaces, earrings, powder and paint pots—no doubt kept filled by the fashionable perfumer of the day, her mirror, wooden comb and various other toilet nick-nacks; and it also contained two long flutes. Happily these had been placed in their proper case; it is owing to this thoughtful precaution that they have been preserved from the decay, which, no doubt, has overtaken many such slender delicate reeds that have been interred with mummies elsewhere. The pipes seem to be made of some thin cane or hollow water-reed. Athenæus says they used to use the lotus-thorn. When found they were of a darkish yellow; but the better to preserve them Mr. Petrie covered them with a solution of wax, as is the custom to dress old articles of wood thus buried.



NOTE.—*A* indicates the mouthpieces, both mouthpieces being in the mouth at the same time; the other letters indicates the notes made by unclosing the respective holes.

One flute possessed four finger-holes, the other three. The measurement of the flute with four holes is: length, 17⅝ inches; to the first hole, 2⅞ inches; to the second, 1⅜ inches; to the third, 1⅜ inches; to the fourth, 1⅜ inches; and to the end, 10⅝ inches. The measuremeut of the flute with three holes is: length, 17⅞ inches; to the first hole, 1⅝ inches; to the second, 1⅜ inches; to the third, 1⅜ inches; to the end, 13½ inches. The outside diameter is but a ¼ inch, so they are exceedingly slender. We can get a fair idea of their size by remembering that they are about the thickness of any ordinary lead-pencil. The finger-holes are not round, as in present flutes, but oval. This was most likely because round holes would have weakened the pipes. These pipes were evidently much too precious to be handled much or experimented with to any extent. *Fac similes* were made with thin brass, cane, and paper, and as they gave exactly the same sounds as the originals, experiments were continued with them. There was considerable doubt how these

antique flutes were blown. It seemed at first as if they must have been blown across the tops as you blow into a key, and as is done in modern Egypt with the "nay." But, though they yielded distinct notes, they were not true musical tones, and all efforts to increase their intensity was unavailing. Many experiments were tried, the successful one being the use of a simple reed cut in a straw of wheat. All evidence seems to point to the fact that this was the medium adopted by the Egyptian players. In the cases of some discovered flutes, pieces of barley straw were found beside them, and in one case a piece of straw was sticking in the embouchure of the pipe. The most conclusive evidence, however, is from a painting taken from a tomb in Thebes, and now in the British Museum in London. This painting represents a feast and dance in honor of the god Vulcan; girls are represented playing on pipes exactly corresponding to those under consideration, with this important exception: about an inch before they enter the mouth the brown color ends, and the rest of the tube is white. So experiments were made in various ways of cutting the straw, with the result that at least the silence of 3000 years was broken, and the double flute of the Lady Maket spoke once more.

And now we come to the importance of the discovery from a historical point of view. Groves' "Dictionary of Music" is the principal authority on all musical subjects that has been published during the last few years. In the article on "Scale" we read that our scale dates from the time of the Greeks, 500 B. C. From the tones elicited from the Lady Maket's flutes we find that in 1500 B. C. they used precisely the same intervals of scale, the same arrangement of tones and semitones as we do to-day. We got our scale *through* the Greeks, not *from* the Greeks; and Miriam sang her song—whatever the tune may have been—in a scale built in the same way as the scales in which we sing and play, nearly 1900 years after Christ.

The notes which have been distinctly elicited from the newly discovered flutes, are sufficient for the purpose of proving that the division of tones and semitones was the same at that early date as it is to-day. It stands to reason, however, that after a burial of 3,000 years, these instruments cannot at once find lips and fingers skilful enough to produce their entire possibilities. It is more than likely that by different pressure of blowing, and by use of the harmonic

notes, as in modern flute playing, an entire chromatic scale can be produced; and doubtless further investigation and experiment will give us more definite information on these points. The use of the harmonic notes is the more likely when it is considered that the fundamental tones more easily produced are of very light quality and weak tone; and as these flutes were the kind used in funeral processions, their sound would be lost in the shuffling of feet; whereas the harmonic tones are more penetrating and would not be so easily lost.

Of course each new discovery in any department of science is considered as all important, very often as the furthest possible reach of investigation. We are apt to think it is impossible that anything more can be done in the way of rapid travel than the modern express train or the Atlantic greyhound. Still the experience of the past has shown us that there are more wonders to come. Notwithstanding past experience, one cannot help feeling that it is very unlikely that we can get any nearer to the creation of the world in the matter of musical history. And that these discoveries bring us very near to the beginning of the world's history is evident when you reflect that we have discovered flutes which were in use when the matters recorded in the earlier chapters of the Book of Exodus were being enacted in Egypt. It is exceedingly unlikely that any instruments of greater antiquity can be discovered, and it is hard to imagine in what other way any authentic information can be discovered. Truly, however, we live in an age of wonders, and there is no telling but within the next few years, some of the indefatigable gentlemen who are continually excavating, deciphering and interpreting in those distant Eastern lands, may turn up the tomb, mummy and musical library and instruments of Jubal himself; and then, surely, we shall be as far back as it is possible to go, if Genesis IV, 21, is a reliable record, as we have all been taught to believe.

BOTANICAL JOTTINGS.

Extracts from paper read before the Hamilton Association, 14th May, 1891.

BY A. ALEXANDER.

* * * * * *

My object in this paper is not to speak of Botany in general, either as to its study or history, for both of those have been already brought before this Association in able and charming papers, read by our friend Dr. Burgess, of Montreal. I would rather content myself by simply relating some facts and observations clustered around a few plants that are familiar to myself, hoping that some of those hearing me may be induced to begin this delightful study, and that perchance those who have commenced the study of plant life may be led to form a closer intimacy and friendship with Flora's children, and thus be led to go beyond the mere collecting, arranging and classifying of plants, to study the plants themselves, that is, study the organs or parts of plants in regard to the different forms and uses which the same kind of organ may assume. This is what we call vegetable morphology. Without this, Botany may be made one of the dullest, while with it, it is one of the most alluring of all the sciences. And since the introduction of the *new* morphology, Botany has been redeemed from what I might call the vicious circle of mere classificatory schemes, and brightened by the fresh and quickening breath of the new thoughts and ideas in regard to the unity of all the living organisms comprehended in the animal and vegetable kingdoms.

* * * * * *

There has also been a new physiology, as well as a new morphology in recent years, which has fixed all its attention on the adaptation of the plant to its natural environment. This I treated of at some length in a paper entitled the "Elasticity of Plant Constitution," read before the Biological Section about a year ago, and therefore will not say more on that here. The fascinating study of the mutual relations between flower and insect

in particular, which was set on foot about the close of the last century by Sprengel, has been introduced with new force in our own times. The results of observations in this direction can be best understood by reading such books as Darwin on orchids and those on cross fertilization. Some of them, I think, are now in our Free Library. Since his time, recent as it is, many have followed up the subject, and Lubbock, Müller and others have added much to our stock of knowledge, so that the study may now be made as fascinating as the reading of a first-class novel, and much more real, because more true.

* * * * * *

The fact is, I think the clue has now been found to all the main avenues of the science, and even the keys of its lesser inner rooms are, for the most part, well within the reach of any enlightened observer.

I want specially to-night to call attention to the arrangement for cross-fertilization in one or two plants with which I am familiar, for to speak of the various modes and arrangements plants have for accomplishing this would fill volumes; it is one of the most interesting parts of botanical study.

Time would fail to tell of the sedges so inconspicuous to the ordinary observer, and yet so full of entrancing wonderment on close examination, in this matter of ensuring cross-fertilization; of the night-blooming plants, which depend on moth fertilization, being nearly always white or pale yellow—good reflectors in the twilight or moonlight—and fragrant, as the moth hunts by smell chiefly, though partly guided by sight; and many others.

Emerson tells us in his "Life of Thoreau" that he was out one day for a walk with him when he (Thoreau) was looking for the "*Menyanthes trifoliata*" (Buckbean), a sweetly scented bog plant. He detected it across the wide pool, and on examination of its florets, decided that it had been in flower five days. He then tells us that he drew out of his pocket his diary and read the names of all the plants that should bloom on this day, whereof he kept account as a banker when his notes fall due. "The Cypripedium not due till to morrow," he added. That would mean about the 20th May, near Concord, Mass., where Thoreau lived; here it would be about a month later, and in the north where I first

made the acquaintance of Thoreau's Cypripedium, about July 1st.

This habit of exact observation of the time and place of the blooming of plants is a most important one, and adds much to the interest and value of the study. I would advise all who are entering upon the study to practise it; you will thereby gather a large and valuable fund of interesting information; you will then be able to tell when you may go into the woods and find the plant you are in search of.

I would like to remark here that in preparing a Local Flora, the time of flowering of each plant is an important consideration. I am satisfied that many interesting facts in this connection escape the notice of botanists, because of their reliance upon the dates given in the manuals. Take the time of the flowering of the *Hepatica Triloba*, for instance, one of the most common Spring flowers. I have found it in Mount Albion ravine as early as the second week in March, while it has been found on one or two occasions as early as the last of February. The difference is not always in the season so much as in the fact that we do not think to look for them so early, or do not know of the most likely situations to find them in bloom.

When the flowers of *Hepatica* come out in Spring, the last year's leaves are still present, but apparently functionless. The new leaves are developed, and perform their work during the late Spring and Summer months, resulting in the production of one or more buds in which are contained the rudiments of next year's development.

If these buds be examined in, say November, they are found to consist of from five to seven scales enclosing each other, and under each, except the first one or two, will be found a flower bud on a scape a quarter of an inch or less long, the whole being densely covered with long silk hair, which must afford much protection during severe weather. In the centre, covered by the flower buds and their protecting scales, the rudiments of next year's leaves are found, also thickly covered with long straight hair. The outermost flower blooms first, and, when there is a lack of warmth, seems to appropriate to itself all the activity of the plant, lengthening its scape to one or two inches, coming into bloom and even perfecting its seeds while the other flowers remain snugly covered by their protecting scales. Sometimes a second bud will burst from its scale before the first has run its course. The scape is always shorter in these early

blooms. Of course, in April and May, these buds all come into flower at once, and are usually found open together, forming a beautiful object in the early spring days. It is wonderful the size the Hepaticas will attain to when they are free from the struggle necessary to keep their place among many competitors. I have some planted in my garden, growing in the shade of a cedar hedge, some of them with no less than sixty-five flowers out at the same time.

These folded early flowers and leaves may be seen by securing a whole plant in the late Autumn or early Winter, and cutting it vertically through the centre, when, with a glass of moderate magnifying power, the beautiful provision for the protection of these earliest floral gems may be seen as I have described above.

But let us return to this Cypripedium. It belongs to the family of orchids, a high-bred race, fastidious in habits, sensitive as to abodes. Most orchids are rare in our northern flora, and yet, as those of us who have gathered these charming plants must have often felt, even this species, which is certainly not one of the very rarest, retains the family traits in its person, and never loses its high born air and its delicate veining. As I come across it in my wandering in the summer among the rocky islands of the inner channel of the Georgian Bay, under some evergreen, standing holding up its head with graceful dignity, I invariably get down beside it in its soft mossy bed and fondle it, and can never divest myself of the feeling that each specimen is a choice novelty. It certainly is *choice* if it is not a novelty. The specific name of this plant is *Cypripedium acaule.*

* * * * * *

To any who appreciate curious forms as well as graceful outlines and brilliant colors, there can be no wild flower of our own woodlands more attractive than the Pink Lady's Slipper. The generic name signifies Venus' Slipper, and Americans have called it the Moccasin Flower, from its marked resemblance to the foot covering of the Aborigines. The popular name given to the common species of France—C. Calceolus—is "Sabot de la Vierge" and "Soulier de Notre Dame," or, "Our Lady's Slipper." It seems to be a passion with the reverent children of the Church of Rome to dedicate the most beautiful things of earth to her who, in their thought, is the most beautiful being in heaven; so it seems the

flower now under review is one of these. Like most orchids it has an arrangement of parts which renders it very difficult, if not impossible, to be fertilized by its own pollen. The stamens and pistils are united into a single organ called the "Column," which projects forward from the stem into the open space at the top, and within the sack-like labellum or "lip." The stamens lie back of the stigma in such a position that the pollen could not, except by the help of insects or other artificial means, be transferred from the one to the other. But the flower is admirably contrived so as to solicit and use the help which such insects as bees and flies may bring to it. The large, gayly colored pendant bag, which makes the most conspicuous part of the flower, is opened with a narrow slit down the front, and the edges of the opening are turned inwards. This forms a regular trap, easy to get into (as most traps are), but quite impossible to get out of—at least by the same door. The "busy bee," searching for toothsome morsels, easily penetrates to the interior of this floral sac through the narrow open door. Once in, and satisfied, he looks about him for a way out. He finds it at last, but not by the way he came in. At the top of the flower, on either side of the "Column," he finds a passage into the open air, quite wide enough for a small but enterprising bee to push his way through. In doing this, however, he brushes against and frequently carries away upon his hairy sides or back the sticky pollen masses of the open anthers. Now, if he enters another flower of the same species, as he will be very likely to do if he got something to his taste in the other, and in due time makes his exit through the only open door, he will certainly get some of this pollen on the stigmatic surface of that flower, and fertilize it, for the stigma is covered with minute papillæ, like the teeth of a comb, which project forward, and the pollen is effectually combed off him as he goes by.

Yet, notwithstanding this elaborate contrivance for fertilization, and this curious adaptation of means to that end, it remains true, as I have proved by actual observation, that few plants are ever fertile, they being chiefly propagated by the root, which keeps its life from year to year.

Just one more example, to give me an opportunity to speak of another and very different fertilizing agency, namely, the wind. Wind-fertilized plants, as a rule, are not attractive, by reason of the almost colorless or entirely absent petals, and the one I choose is,

perhaps, the least interesting of all plants, except when we happen by accident to come into too close contact with it. I mean the common nettle, which you may see almost anywhere in waste, neglected spots, and in perfection on the side of the mountain, eastward, on the north side of the railway track, where they sometimes reach the height of six feet.

You are familiar with the nettle. What a contrast to the beautiful orchid which we have just discussed! We might speak of its sting. As a rule, the sting is the only point in the whole organization of the family over which we ever waste a single thought. I am afraid that is because of our own ordinary human narrowness. In each plant or animal, we interest ourselves about that one part alone which has special reference to our own relations with it for good or for evil. In a strawberry, we think only of the *fruit*; in the orchid, which we have had in review, of the *beauty of the flower*; in a deadly nightshade, of the *poisonous berry*, and in our nettle, of the *sting*. Now I frankly admit that the nettle sting has an obtrusive and unnecessarily pungent way of forcing itself upon human attention; but that does not sum up the whole life history of the plant. The nettle exists for its own sake we may be sure, and not merely for the sake of occasionally inflicting a passing smart upon meddlesome fingers. Let me further say, before we leave the nettle sting, that I think it one of the most highly developed among the devices by which plants guard themselves against the attacks of animals.

But let us to the flower. In most plants the flower is the most conspicuous part of all. Yet in this particular plant it is so unobtrusive that most people never notice its existence in any way. That is because the nettle is wind-fertilized, and so does not need bright and attractive petals. The flowering branches of the nettle consist of a lot of little forked anther-like spikes, sticking out at right angles to the stem, and half-concealed by the leaves of the row above them. Like many other wind-fertilized flowers, the stamens and pistils are collected on different plants, a plan which insures cross-fertilization without the aid of insects. If we pick one of the stamen-bearing clusters, we will see that the flower proper is made up of four tiny leaf-like petals, and with four stamens doubled up in the centre. If we touch one of the ripe flowers with the point of a pencil, or some fine point, in a second the four stamens jump out elastically as if alive, and dust the white pollen all over our fingers. Why should

they act like this? Such tricks are not uncommon in bee-fertilized flowers, because they insure the pollen being shed only when a bee thrusts his head into the blossom; but what use can this device be to the wind-fertilized nettle? I think the object must be something like this: If the pollen were shed during perfectly calm weather, it would simply fall upon the ground without reaching the pistils of neighboring plants at all; but by having the stamens doubled up with elastic stalks it happens that even when ripe they do not open and shed the pollen unless upon the occurrence of some slight concussion. This concussion is given when the stems are waved about by the wind, and then the pollen is shaken out under circumstances which gives it the best chance of reaching the pistil.

We leave our nettle by remarking, that as regards *stings*, it is one of the best protected plants; as regards *flower* and *fruits*, it is merely one of the ruck. So we see one plant survives by dint of its prickles, another by dint of its attractive flowers, a third by its sweet fruit, and a fourth by its hard nut shell, and so on.

Thus there is opened up to us a vast field of interesting study, with a profusion of the most fascinating paths around the whole, and outside of technical names and formal classification, not excelled by any other branch of scientific study and accessible to us all. When these facts in plant history and life come to us, we feel that our life is too short to read but a very few of the entrancing pages of this wondrous book of nature.

Report of the Philological Section.

HAMILTON ASSOCIATION,

MAY, 1891.

The Philological Section was organized at a meeting held on the 20th of November, 1890, when a chairman and a secretary were elected and a night of meeting chosen.

Five meetings have been held, and it is proposed to hold two more before the summer holiday season.

The papers read have been as follows :—

DECEMBER 18th.—"The Life and Work of F. Bopp."—H. P. Bonny.
"The Home of the Early Aryans."—A review of the discussion, suggested by Canon Taylor's work.—Chas. Robertson, M. A.

JANUARY 15th.—"An Introduction to the Study of Grimm's Law."—A. W. Stratton, B. A.

FEBRUARY 26th.—"The Origin of Languages."—Presenting the claims of Hebrew.—Dr. H. Birkenthal.

MARCH 26th.—"The Development of the French Language."—An examination of the circumstances under which it arose.—W. H. Schofield, B. A.

APRIL 23rd.—"Anglicisms in Lower Canadian French."—H. P. Bonny.

Each paper has been followed by a somewhat full discussion of matters of interest suggested by it: twice lists of topics have been distributed among the members some time before the meeting.

The section has been above all things instructive. Original work is not to be expected at first; but the number of workers is very promising, and augurs well for the future success of the section.

A. W. STRATTON, *Secretary.*

CHAS. ROBERTSON, *Chairman.*

AN INTRODUCTION TO THE STUDY OF GRIMM'S LAW.

Read before the Philological Section, January 15th, 1891,

BY A. W. STRATTON.

When a man's attention has been drawn to the language of another people, he is constantly on the watch for points of resemblance with his own; and he who seeks will find perhaps not a few. It was so in a marked degree when the study of Greek literature became popular at Rome. How largely the vocabularies of the two languages agreed may readily be seen from such a comparison as that made in Halsey's "Etymology of Latin and Greek;" and the comparatively early development of Greek civilization caused this agreement to be explained as due to the derivation of the Latin from the Greek of an early time. Something very similar occurred when Englishmen noticed how many of their words, not known to be imitations of any foreign words, differed but slightly from the Latin, it might be, or the Greek or the Hebrew; and the theology of the time required that all should be traced to Hebrew, the original speech, it was said, "used between God and man."[1] Here was a vast and inviting field of study, but the rude guess-work of the first attempts at comparison made the results almost valueless.

Some valid distinctions were, of course, made before the days of scientific etymology, *e. g.* that of the relations of the English *fraternal* and *brotherly* to the Latin *frater*. This distinction was recognized by Horne Tooke[2] (1736-1812), a man to whom it was given to see darkly and partially many of the things made clearer to us by the study of Sanskrit, then unknown in Europe. How nearly he anticipated Rask and Grimm may be seen from the following passage:[3] Speaking of prepositions he says:—"Though it is not from Asia or its confines that we are to seek for the origin of this part of our language, yet it is worth noticing here that the Greek, to

(1) See Pres. White's article in the Popular Science Monthly, Jan., 1891.
(2) See his "Diversions of Purley, Bk. II., Ch. 6.
(3) Divers. Purl., I. 9.

which the Gothic has in many respects a considerable resemblance, employs the word *thura* for *door*, and both the Persian, which in many respects resembles the Teutonic, and the Chaldæan use *thro* for *door*. The modern German (directly contrary to the modern English) uses *thur* for our *door* and *durch* for *thorough*; and it is remarkable that this same difference between the German and the English prevails in almost all cases where the two languages employ a word of the same origin having either of these initials." He instances *distel* and *thistle*, *dorn* and *thorn*, *theur* and *dear*, *thaler* and *dollar*, *theil* and *deal*. Attention to the sound rather than the spelling of these German words might have led to a tenable theory of consonant-shifting. But everything cannot be expected from Horne Tooke, and to show the progress made by modern etymologists we must quote from him again (*loc. cit.*) :—"*Do* (the auxiliary verb, as it has been called) is derived from the same root, and is indeed the same word, as *to* [of the infinitive.] The difference between a *t* and a *d* is so very small, that an etymologist knows by the practice of languages, and an anatomist by the reason of that practice, that in the derivation of words it is scarce worth regarding."

When the Sanskrit came to be studied in Europe, a comparison of its forms with those of Persian, Greek, Latin, Gothic, English, German, Celtic, etc., showed beyond all doubt

(1) That these languages were all connected both in vocabulary and in grammatical forms;

(2) That no one of them could be said to be the parent of the others, but that all alike must be referred to a common source.

Rasmus Christian Rask (1787-1832), a Danish scholar who, at thirty-five years of age, "was master of twenty-five languages and dialects, and is stated to have studied twice as many,"(1) extended in his essay on the origin of Icelandic (1818) the list of correspondences of letters in the Classical and Germanic languages previously established by a Swede named Ihre. Four years later Jacob Grimm (1785-1863) published in the second edition of his "German Grammar" a law of shifting of mutes not only as between the Germanic and Classical languages, but also as between the High German, especially in its older forms, and the remaining Germanic dialects.(2)

(1) Encycl. Brit. Vol. XX., p. 286.

(2) On the extent of Grimm's debt to Rask see Sweet's article in the Encycl. Brit., Vol. XI., pp. 200-201.

From his comparison Grimm finds the changes of the vowels in the Germanic dialects to be "not arbitrary, but on the contrary according to a deeply-rooted but as yet undiscovered law" (Ger. Gram., Vol. I., p. 580). In the consonants, however, "the relations appear more certain and permanent; dialects whose vowels for the most part differ, retain frequently the same consonants. The four liquids (*l*, *m*, *n*, *r*) are constant......Like the liquids run the three spirants (*v*, *h*, *s*), essentially unchanged through all the German dialects......Quite otherwise is it with the other consonants; a marked difference between the High German and all other dialects is revealed. In the labials, linguals and gutturals, the Goth. tenuis answers to the H. Ger. aspirate, the Goth. media to the H. Ger. tenuis, the Goth. aspirate to the H. Ger. media" (pp. 580-1.) These results he tabulates as follows:

Goth.....	P	B	F	T	D	Th	K	G	
O. H. G. .	F	P	B (V)	Z	T	D	Ch	K	G

A comparison of Germanic with Greek, Latin and Sanskrit consonants leads to an extension of this law. "Even more worthy of remark," he says, "than the agreement of the liquids and spirants is the difference of the lip, tongue and throat sounds [of Greek, Latin and Sanskrit], not only from the Gothic, but also from the Old High German system. Precisely as the Old High German in all three classes has removed one step from the Gothic form, the Gothic was itself already shifted one step from the Latin (Greek, Sanskrit). The Gothic is related to the Latin just as the Old High German to the Gothic:" (p. 584). The whole is arranged in a table thus:

Greek..	P	B	F	T	D	Th	K	G	Ch
Goth...	F	P	B	Th	T	D		K	G
O.H.G..	B(V)	F	P	D	Z	T	G	Ch	K

and thus:

Gr.	Goth.	O.H.G.	Gr.	Goth.	O.H.G.	Gr.	Goth.	O.H.G.
P	F	B (V)	T	Th	D	K		G
B	P	F	D	T	Z	G	K	Ch
F	B	P	Th	D	T	Ch	G	K

This law of change is best exemplified in the dental series.

Sanskrit.	Greek.	Latin.	Gothic.	Anglo Saxon.	English.	O.H.G.	N.H.G.
daça	*déka*	*decem*	*taihun*	*tien*	*ten*	*zëhan*	*zehn*
dant	*odont–*	*dent–*	*tunthus*	*toth*	*tooth*	*zand*	*zahn*
	dakru	*lacrima*	*tagr*	*tear*	*tear*	*zahar*	*zahre*
dama	*domos*	*domus*	*timr*	*getimbre*	*timber*	*zimbar*	*zimmer*
dha	*the–*	*–do*		*don*	*do*	*tuon*	*thun*
rudhira	*eruthros*	*ruber*	*rauds*	*read*	*red*	*rôt*	*roth*
duhitr	*thugater*		*dauhtar*	*dohtor*	*daughter*	*tohter*	*tochter*
madhu	*méthu*			*medu*	*mead*	*mëtu*	*meth*
tva	*tu*	*tu*	*thu*	*thu*	*thou*	*du*	*du*
tri	*treis*	*tres*	*threis*	*threo*	*three*	*drî*	*drei*
trs	*térsomai*	*torreo*	*thairsan*	*thyrstan*	*thirst*	*dursten*	*dursten*
tanu	*tanaos*	*tenuis*		*thynne*	*thin*	*dunni*	*dünn*

The law is sometimes[1] stated thus:

	Class.	L. Ger.	H. Ger.
I.	A	S	H
II.	S	H	A
III.	H	A	S

Such statements of the shiftings are easily remembered and may be employed with advantage in elementary works to direct attention to the regularity of the changes. But we must not conclude from these popular statements that the change is from the Classical languages to the Low German, and from the Low German to the High German. High German is not derived from Low German, nor does it spring from Sanskrit or Greek or Latin. The change was rather from the "primitive" Indogermanic to the "primitive" Germanic, and from it to High German; the languages cited have a bearing upon the shiftings only in so far as they indicate what we may assume to have been the nature of the mutes in the respective "primitive" forms. Nor must we assume that the symbols A, S, H denote precisely the same sounds in the three columns and conclude that the movement is circular. That was Professor Earle's view when he wrote in his "Philology of the English Tongue" (pp. 6-7):—"A succession of small divergences, which run upon stated lines of variation—lines having a determinate relation to one another, and constituting an orbit in which the transitional movement revolves,—this is a phenomenon worthy of our contemplation. It is the simplest example of a fact which in other shapes will meet us again, namely, that the beauty of philology springs out of that variety over unity which makes all nature beautiful and all study of nature profoundly attractive." But the discourse is based on the misunderstanding of the text.

These considerations suggest another statement of the law. The first shifting may be set down as follows:—*In the Germanic branch the primitive Indogermanic mutes underwent a general shifting; the aspirates were changed to mediæ, the mediæ to tenues, while the tenues become fricatives.* To the examples given above the following may be added in the other series.[2]

(1) As in Morris' "Historical Outlines of English Accidence."

(2) For convenience, High German equivalents are given here.

Sanskrit.	Greek.	Latin.	Gothic.	Anglo Saxon.	English.	O.H.G.	N.H.G.
bhaj-	*phegos*	*fagus*		*bece*	*beech*	*buohha*	*buche*
bhuj (1)	*pheugo*	*fugio*	*biugan*	*bugan*	*bow*	*bougen* *boucken*	*beugen*
çana	*kannabis*	*cannabis*		*hænep*	*hemp*	*hanaf*	*hanf*
		(s)lubricus	*sliupan*	*slupan*		*slīfan*	*schleifen*
pad	*pod-*	*ped-*	*fotus*	*fot*	*foot*	*fuoz*	*fusz*
	por-euo	*ex-per-ior*	*faran*	*faran*	*fare*	*faran*	*fahren*
hamsa	*chen*	*(h)anser*	*gans*	*gos*	*goose*	*gans*	*gans*
hyas	*chthés*	*heri*	*gistra*	*giestra*	*yester-*	*gëstre*	*gestern*
jna-	*gi-gno-sco*	*(g)nosco*	*kunnan*	*cunnan*	*know*	*chennen*	*kennen*
janu	*gonu*	*genu*	*kniu*	*cneow*	*knee*	*chniu*	*knie*
çrad	*kardia*	*cor(d)*	*hairto*	*heorte*	*heart*	*hërza*	*herz*
kapala	*kephale*	*caput*	*haubith*	*heafod*	*head*	*houbit*	*haupt*

(1) These words, as Lanman remarks, "So far as the meaning goes may well be taken as cognate; but the Germanic raises phonetic difficulties which are not yet satisfactorily cleared up."

We must now seek to determine the time of this first general shifting. Our earliest sources of knowledge of the forms of the Germanic languages are the Germanic words quoted by Latin writers, as *sapo* by Pliny, *framea* and *glaesum* by Tacitus. If the Goths and Getæ are identical, the plant-names from Dacia given by a Greek writer, Dioscorides, deserve consideration.(1) Dating from about the same time are some words borrowed from the Scandinavians by the Finns and Lapps, as Finnic *nuotta* 'net' (Old Norse *not*), *raippa* 'rope' (O. N. *reip*), and Lappic *saipo* 'soap' (Swedish *sapa*), *divres*, 'dear' (O. Sw. *dyr*): these words are quite numerous. Next in order of time we have a number of inscriptions in Runic characters from about 250 A. D., all of which are short; one from Wallachia, coming from heathen times, reads *Gutoniowi hailag* 'dedicated to the temple of the Goths.' Far more satisfactory as an evidence of the character of the language in early times is the translation of the Bible into Gothic made by Wulfila (311-381 A. D.); the most important of the manuscripts is of the sixth century, but the forms are certainly much earlier, for it is doubtful whether the language long survived the maker of the translation. Judging by these data we may safely conclude that the shifting began before the time of Christ; in the Gothic we find it practically complete.

The history of the alphabet also throws some light on the matter. Canon Taylor in his "Greeks and Goths" has urged strong reasons for believing that the Gothic runes were derived from the Ionian alphabet of about 500 B. C. Now the character, which in Greek represents *g*, in Gothic inscriptions denotes *k*, and we have a similar shifting of value from *ch* to *g*: this would seem to indicate the retention of old spellings after the sounds had changed. In the dentals the change of value is from *th*, *d* to *d*, *th* respectively, while the sign for *t* remains unchanged. Whatever conclusion we draw from these facts concerning the nature of the first sound shifting, we can see that the tendency to change did not cease for some time after the introduction of the alphabet among the Goths. Assuming that the words from which come our *hemp* and *path* were borrowed after the German tribes came into contact with Roman civilization, we find the tendency existing still later: but these words were in the language before *Kaiser*, which Kluge believes to be the first borrow-

(1) I do not know anything of these names further than that they are said to be of Germanic form.

ing from Latin. I do not know of any unshifted forms, known to be Germanic, from which we might learn of a time before the general spread of the changes, and so determine roughly the date of its beginning. As to the close of the period, there was no shifting when the words *apostol*, *candel*, *pawa* were introduced into Anglo-Saxon in the sixth or seventh century after Christ.

The second shifting remains to be considered. A reference to the illustrations given above will show that only in the dental series is the shifting complete in Modern German; *p* has become *f*; *b*, *f*, *g*, *k*, *h* remain unchanged. Grimm cited Old High German forms such as *prechan*, *pim*, *kans*, *chuni* to show the completeness of the circle of change; but even in the earlier periods of the language these are found alongside unshifted forms. The shiftings varied in different parts, and were most thorough in Upper Germany. To our partial statement of the law given on page 91 we may add generally that *the subsequent shifting was similar, but varied in extent in the several districts, modern literary German exhibiting a general change only in the dental series.*

We can very well determine the date of this movement. It took place as Sayce[1] points out, at a time subsequent to the wars between the Teutons and Romans which led to the overthrow of the Roman Empire; thus (*via*) *strata* and *campus*, our *street* and *camp*, became in Old High German *straza* and *kamph*, *champf*. The year 600 of our era is assumed to mark fairly well the setting in of the process, but its progress was slow; as late as 842 we meet *dag* (A. S. *daeg*, G. *tag*), and it is interesting, in connection with Mr. Sweet's remarks quoted on page 100, to notice that *godes* (G. *gottes*) existed then beside the nominative *got*.

It is customary to speak of "exceptions" to Grimm's law, and and here may be set down explanations of some forms which the law as stated fails to account for.

1. Onomatopoetic and imitative words at once suggest themselves. The sounds of the parent language remain practically unchanged in Gr. *klagge* (*gg* = *ngg*), L. *clangor*, E. *clang*, G. *klang*, and like words, for they are all imitations of like natural sounds. With these may be grouped such words as Gr. *pappa*, L., E. and G. *papa*, which are merely doublings of the earliest formed sounds

(1) Introduction i., 307.

serviceable for speech, and, as children's words, not likely to be influenced by the analogy of shifted forms.

2. Again we find the tenues regularly unshifted in certain combinations :—

	Gr.	A. S.	Eng.	O. H. G.	N. H. G.
sk	*skeptron*	*sceaft*	*shaft*	*scaft*	*schaft*
sp	*spathe*	*spada*	*spade*	**spato*	*spaten*
st	*aster*	*steorra*	*star*	*sterno*	*stern*
ft	*pémptos*	*fifta*	*fifth*(1)	*funfto*	*fünfte*
ht	*okto*	*eahta*	*eight*	*ahto*	*acht*

The permanence of the tenues in these groups is evidently due to the presence of the surd spirants *s*, *f*, *h*. The variation in the *sk* group shown in many instances in modern English (*sh*) and in almost all in modern German (*sch*) does not belong to the primitive Germanic: the early documents of both languages preserve the *k*. Similarly in *fremde* the High German, because of the influence of the sonant *m*, has retained the *d* of the primitive Germanic seen in A.-S. *fremde*. The *d* of the M. H. G. preterite forms *nande*, *rumde*, *solde* is to be explained in the same way.

3. A number of seeming exceptions will readily be understood if we bear in mind the laws of sound change in the several languages. Take for example the cognates Skt. *duhitr*, Gr. *thugater*, Goth. *dauhtar*, A.-S. *dohtor*, E. *daughter*, G. *tochter*, which point to a primitive **dhughatar*. The change in Sanskrit from *dh to d* was evidently to avoid the use of an aspirate so near the *gh*; a similar dissimilation regularly occurs in Greek, as in *pephileka* for **phephileka*. Again, primitive 'mediæ aspiratæ' between vowels were often represented in Sanskrit by *h*. The *g* in Greek is an instance of a change often found, as in *egon* (Skt. *aham*), *mégas* (Skt. *mah*); compare also *brémo* (Skt. *bhramati*, Lat. *fremo*). The retention of *t* in Germanic forms has been explained already: the *h*, *gh*, *ch* require further consideration.

4. When the necessity was shown for postulating the existence of a language which stood in the same relation to the known langua-

(1) For the *th* see below; page 97.

ges of the Aryan family as Latin to the Romance languages, men thought that they were coming near to a knowledge of the primitive speech of man, and the simplicity assumed for it was supposed to belong to the primitive Indogermanic as well. For example the vowels *e, o* were assumed to have been developed at a time when the community had become divided, and similarly only three series of mutes (*p*, *t* and *k* sounds) were allowed to have been original. Now Skt. *jna* corresponds to Gr. *gignosco*, L. *(g)nosco*, Goth. *kunnan*, E. *know*; and Skt. *çata* to Gr. *hekaton*, L. *centum*, Goth. *hund*, E *hundred*; but Skt. *jiv* as evidently corresponds to Gr. *bios*, L. *vivus*, Goth. *kwius*, E. *quick*; and Skt. *catur* to Gr. *tettares*, L. *quatuor*, Goth. *fidwor*, E. *four*. Just as it has been found necessary to assume that *e* and *o* existed in the parent language, so an understanding of these correspondences has been made possible by the recognition of an original palatal series (*k* sounds) and velar series (*q* sounds) in place of a single guttural series.

5. We come now to a series of shiftings first explained by Karl Verner, of Copenhagen, in 1875. In the comparisons given above (page 90) no mention was made of the familiar words *father*, *mother*, which at first seem to illustrate the law so well. In the Middle English equivalents of these words a *d* is almost always found in place of *th*. The following table will be found convenient:—

Skt.	*pitr*	*matr*	*bhratr*
Gr.	*patēr*	*mētēr*	*phratēr*
Lat.	*pater*	*mater*	*frater*
Goth.	*fadar*		*brothar*
A.-S.	*faeder*	*modor*	*bropor* (1)
Mid. Eng.	*fader*	*moder*	*brother*
O. H. G.	*fater*	*muotar*	*bruodar*
N. H. G.	*vater*	*mutter*	*bruder*

A careful examination of such correspondences as these led Verner to the following conclusions:—1st, that the position of the primitive Indogermanic accent was not restricted as in classical Greek and Latin, or modern English and German; 2nd, that in the primitive Germanic the accent was still free in position, but was marked not only by a rising pitch of voice but also by stress secured by expul-

(1) In this and the following table the *th* sound in *thing* is indicated by inverted *t*, and that in *this* by inverted *d*.

sion of surd breath. The several stages in the history of our words *father* and *brother* may be set down thus :—

**patar*, **faþar*, **fapar*, * *fadar*, Goth. *fadar*, A.-S. *faeder*, M. E. *fader*, Eng. *father*.

**bhratar*, **broþar*, ———, ———, Goth *broþar*, A.-S. *bropor*, M. E. *broper*, Eng. *brother*.

The law of change commonly known as Verner's law may be stated as follows :—*Primitive Indogermanic* k, (q), t, p, *shifted without exception to the surd spirants* h, th, f. *But when the vowel next preceding did not originally bear the principal accent, primitive Germanic* h, th, f, *became the sonant spirants* gh, dh, v, *and later the sonant stops* g, d, b. In other words, a surd standing between sonants tends to become sonant, unless some such influence as the expulsion of surd breath in accenting the syllable to which it belongs, counteracts that tendency and causes the retention of the surd.

This principle will explain how the Indogermanic participial suffix *-to* seen in Gr. *poietos*, L. *captus* appears in English as *-d* (*loved*), the original accent following the *t*, while the noun suffix seen in L. *cantus* appears as *-th* (*birth*), the original accent preceding the *t*; again, Skt. *antara* corresponds to Goth. *anthar*, E. *other*, G. *ander* while Skt. *antar* corresponds to Goth. *undar*, E. *under*, G. *unter*. It will explain also the differences in the singular and plural of such Anglo-Saxon preterites as *wearth*, *wurdon* ; *beah*, *bugon*. The same principle is seen in what is commonly known as rhotacism, the change of *s* (in the Germanic languages through *z*) to *r* in syllables originally unaccented. It is thus that we can connect the comparative suffixes of adjectives in Greek and Latin, originally showing *s*, with those of Gothic containing *z* and those of English containing *r* ; and it is thus also that we can reconcile the Anglo-Saxon equivalents of such preterites as our *chose* (sing. *ceas*, plur. *curon*). The recognition of this important principle of sound change has served to make clear some obscure points even in non-Germanic languages.

6. Some seeming inconsistencies in Anglo-Saxon and English forms are to be attributed to our tendency to make words like others with which we are familiar. Such "levellings by analogy" are seen in the change from A.-S. *faeder*, *modor* to E. *father*, *mother* through the influence of *brother* (A.-S. *brothor*), and in that from A.-S. *fifta*,

sixta, to E. *fifth*, *sixth*, by the analogy of such ordinals as *fourth*, *seventh*, (A.-S. *feortha*, *seofotha*), etc.

Enough has been said in regard to this matter to show the wisdom of requiring a physical explanation for every sound-change which we can trace historically, except when there is sufficient evidence of the workings of analogy. We must keep in mind both physical necessities and mental associations. On the relation of these two influences Sayce has said(1):—"It must not be supposed that all the changes of pronunciation that serve to distinguish one branch of the Aryan stock from another took place simultaneously. On the contrary, they were slow and gradual; first one and then another new fashion in sounding words sprang up and became general; when once the new pronunciation had from any cause taken a firm hold of the community, analogy caused every word to be submitted to its influence, unless special reasons, such as accent, stood in the way, until in course of time the process of shifting the sounds was completed."

A question remains: How are we to account for these extensive shiftings in the Germanic group and it alone?

1. At first, when it was thought necessary to assign reasons, climatic influences were appealed to, but we were not told what precise influence on speech-sounds was exercised by the various varieties of natural surroundings. Now it must be admitted that cold and warm, mountainous and low-lying districts have characteristic modes of utterance, especially in the position in which the sounds, whether vowels or consonants, are formed. I do not know of any evidence that changes from sonants to surds or from mutes to fricatives in the same position are due to similar influences. Granting that there is such evidence, it is hard to see what have been the peculiar climatic conditions of the roving Germanic peoples.

2. From Max Müller comes the following theory(2):—The Aryans before their "separation" possessed at least the three orders of mutes seen in *dh*, *d*, *t*. The Latins lost the aspirates and were content to denote them by spirants (*f*, *h*) or mediæ. The low German tribes also lost the aspirates, denoting them by mediæ, but for purposes of distinction pronounced original mediæ as tenues, and again were forced to represent the tenues by the fricatives. The

(1) "Introduction" i. 308.
(2) Science of Language, Vol. II., Lecture V.

High-German similarly, substituting tenues for the original aspirates, had to employ mediæ for original tenues and breaths for original mediæ.—The mistake of assuming that the so-called Low and High German shiftings were contemporaneous has been shown above (p. 91). The account of the second shifting is quite misleading; the value of the explanation suggested for the first may better be considered later.

3. The anthropologists have shown that from the earliest times men of more than one race have spoken Aryan languages, and there is much to favor the view that the divergences we have noticed are due, at least in part, to the acquirement of the language by a people of another race. Canon Taylor (1) notices a significant fact connected with the second shifting. "By race the North-west region of German speech is largely Teutonic, the Eastern Lithuanian and Slavonic, the central region is Celtic, and the Southern is Ligurian. ......During the last thousand years German speech has been slowly winning back its lost provinces, but without displacement of population......The Low German speech of the conquerors was modified when it was acquired by the native tribes. The primitive Low German dialects are only spoken in those Frisian and Dutch districts which are Teutonic in blood as well as speech." Experience shows the correctness of the following:—"We may take it as an axiom that, whenever a new language is acquired by foreigners or by subject races, there will be a class of sounds which will be pronounced with difficulty and will therefore as a rule be evaded or inaccurately pronounced. *This is especially the case with the soft and aspirated mutes*." (V. 5.) The Germanic languages seem to have departed furthest from the primitive sound system and to have lost more than others of the primitive inflections. This accords well with the theory that the Germanic peoples were originally non-Aryan.

4. No theory, however, concerning the general Germanic shifting can be considered satisfactory, if it fails to take account of similar changes occurring to a limited extent in several cognate languages.

(a) In old Iranian *p*, *t*, *k* were unchanged only before vowels and and after sibilants; otherwise they became spirants, as Avestan and Old Persian *fra*, Skt. *pra*, Gr. *pro*, Lat. *pro*, E. *for*. In Greek they seem to have retained generally their form of

(1) Origin of the Aryans, Ch. V. 2.

articulation. "In some districts" says Brugmann [1] "especially in Attica the sounds appear to have been spoken for a long time with aspiration. Yet from the inexactness and inconsistency of the written representation it is not possible to determine accurately the extent of the tendency." In the Umbrian and Oscan dialects in Italy *kt* and *pt* became *ht* and *ft*, as Umbr. *rehte*, L. *recte*; Osc. *Uhtavis*, L. *Octavius*. In Old Irish after vowels *t* and *c* became the spirants *th*, *ch*, as *mathir*, L. *mader*, E. *mother*, etc.

(b) In Armenian mediæ became tenues, as *tiv*, Skt. *div*, L. *dies*.

(c) In Iranian, Old Irish and Balto-Slavic, for the most part in Armenian, and medially in Latin, aspirated mediæ became simple mediæ, as Lat. *medius*, O. Ir. *medon*, Skt. *madhya*.

Similar shiftings in Greek have been noticed above (p. 95). The Germanic shiftings may be due to such causes, whatever they were, as produced the changes just noticed, only that the former became general probably by the working of analogy. "Most sound-changes," remarks Sweet [2] "seem to begin under special circumstances, and if they do extend themselves over the whole range of the sound in question, it is only gradually. A change such as that of *d* into *t* may begin at the end of a breath-group, and be then extended to the ends of words within a breath-group, as in German, and finally to all the *d*'s in the language, as when every Arian *d* became a *t* in Germanic." In the Germanic, with its want of a literature, or, as Canon Taylor would rather say, because of the want of a literature in the language adopted by the Germans, there was no language-tradition strong enough to secure unshifted forms against the influence of analogy; while on the other hand the people of India, Persia, Greece and Rome used a language which was in a manner fixed in literature.

The last word has not been said on Grimm's law. Enough general statements have been made concerning it, and numberless conclusions made regarding the early relations of the peoples with whose languages it has to do; but how few of these are trustworthy! Stricter methods, it is to be hoped, will give more reliable results. Especially a better determination of the nature of the sounds in question, and a careful study of the High-German shifting and of modern German dialects may make clear many things that are yet obscure.

(1) Grundriss I. Sect. 486.
(2) History of English Sounds, p. 16.

ANGLICISMS IN LOWER CANADIAN FRENCH.

Read before the Philological Section, April 23rd, 1891.

BY H. P. BONNY.

The subject of which this paper treats should be one of considerable interest to us as Canadians; and, from a philological point of view, it must always prove a matter worthy of attention to notice the effects produced upon language from the intimate association of two races speaking different tongues, yet united under the same central government. This paper is little more than a collection of specimens of the Anglicisms in common use in Quebec, hastily gathered from such sources as I had access to. Still, if I can but induce others to take up the subject, my labor will not have been altogether in vain. The majority of my illustrations are to be found in M. Alphonse Lusignan's "Fautes à corriger" and in the corrections published by him in the columns of *La Patrie*, under the heading of "Corrigeons-nous." I am under a lasting obligation to M. Lusignan, not only for his kindness in authorizing me to use any matter bearing on my subject written by him, but also for the trouble he has taken in answering certain questions I propounded. He, moreover, wrote in my behalf to M. Napoleon Legendre, of Quebec, who has kindly presented me with his most valuable little work entitled "La Langue Française au Canada," which has been of great use to me in preparing this paper. Mr. Robert Sellar, of Huntingdon, was kind enough to write a letter full of information bearing on the subject, from which I will quote later on.

I will divide the Anglicisms into five classes:

(1) Colloquial;
(2) Journalistic;
(3) Legal;
(4) Commercial;
(5) Parliamentary.

In most, if not all languages, we find certain words performing yeoman service—for instance, the verb *faire* in French and the substantives *Schlag* and *Zug* in German. Mark Twain remarks of the

two words above mentioned: "In Germany, when you load your conversational gun, it is always best to throw in a *Schlag* or two and a *Zug* or two, because it does not matter how much of the rest of the charge you may scatter, you are bound to bag something with them." In English, "box" and "set" will serve for examples of words conveying meanings which in other languages it requires a number of different words to define. Hence we find the French Canadian using our word "set" instead of *parure* if he is speaking of a set of diamonds; of *meuble* or *meublement* if furniture is under consideration; of *serie* or *collection* in the case of books; of *service* if a tea set is spoken of. Then we have *set de broches à tricoter* instead of *jeu de broches*, etc., "a set of knitting-needles;" *set de dents* for *dentier*, "set of false teeth;" and many other instances.

In English we have the word "epergne" to designate a sort of table ornament. It looks and sounds very much like a genuine French word, but you will not find it in Littrè. It has found its way into the language of our neighbors in Quebec to take the place of *surtout de table.*

If a young man is about to take unto himself a wife we say "he is going to marry so-and-so," and we accordingly find some French Canadians borrowing this expression and saying *il va marier telle ou telle* when they should say *il épouse*, etc., or *il va se marier avec*, etc.; *il va marier* would mean that he intended to give his sister or some one in marriage. Our English "stand" in the sense of "cabstand" is in common use instead of *place de fiacres.* Our verb "to originate" appears in the form *originer* instead of *provenir* or *tirer son origine.*

If we are certain about something we say "I am positive of it;" this phrase has been borrowed and *J'en suis positif* is found taking the place of *J'en suis sûr, certain.* "Castor oil" becomes *huile de castor* instead of *huile de ricin*: *huile de castor* would mean "beaver oil." An *almanach des adresses* or *bottin* is often converted into *directoire* or *directory.* A locomotive is frequently called an *engin* from our engine. Sometimes a French Canadian is found saying: *Venez que je vous introduise a Mlle. telle ou telle*, making use of a literal translation of our word "introduce," when he should say *Venez que je vous présente*, etc The housewife will talk of *coalail, sassepanne, fleur*, and *sideboard*, instead of *pétrole, casserole*, or *coquemar, farine* and *buffet.* Her husband will speak of his *bottes de cuir patent* instead of *cuir verni*, and, if he be a sportsman, of his *ammunitions*

instead of *munitions*. *Je vous fais apologie* is used instead of *je vous fais excuse ; change pour un dollar* often takes the place of *monnaie pour un piastre (dollar)*. *Elle chante a la perfection* is used instead of *en perfection*, *dans la perfection*.

Among other colloquial Anglicisms may be mentioned : *payer un compliment* for *adresser un compliment ; payer ses respects* for *présenter ses respects ; salle à diner* for *salle à manger ; loquet* for "locket" instead of *medaillon (loquet* is a door latch); *consistant* for "consistent" instead of *logique*, *conséquent ; avoir de trouble* for *avoir de peine*, *difficulté*, *mal ; permettez que je vous trouble*, etc., for *que je vous dérange*, etc. Then we find a number of English verbs adopted and conjugated according to the first conjugation, for example :—*bouncer*, *bolter*, *blackballer*, *biter* (to beat), *scréper* (to scrape), *slaker* (to slack), *logher* (to log), *saider* (to side track). This last example is a very convenient Anglicism, for its French equivalent is *pousser les wagons sur une gare d' évitement*.

I will conclude this list of colloquial Anglicisms with a choice specimen of Acadian French, quoted by M. Lusignan, from an article on the French Canadian press that appeared in a French review :—"Je voudrais bien vous *driver*, mais ce matin j'attelai mon *team*, et a peine sortie de la *stable* les chevaux prennent leur *race*. Ah ! ça allait *fast !* Et quand je vins pour dévirer [O. F. = tourner] le *corner*, je tombe par terre, les chevaux partirent tous seuls. Ils furent pognés [O. F. = blessés] et je fus *findé*."

I will now proceed to the Anglicisms to be met with in the daily papers. First of all, here is a list of words which, although French, are often printed as spelt in English : *libel*, *rebel*, *traffic*, *exercise*, *dance*, *license*, *sulphuric*, *tansy*, for *libelle*, *rebelle*, *trafic*, *exercice*, *danse*, *licence*, *sulfurique*, *tanaisie*. Names of foreign cities are frequently to be met with in their English form instead of the French one : thus we have *Antwerp*, *Leghorn*, *Athens*, *Cairo*, *Mecca*, *Hague*, etc., for *Anvers*, *Livourne*, *Athènes*, *Le Caire*, *La Mecque*, *La Haye*, etc. We find *un éditorial* or *un article éditorial* used in the place of *un article de fond*, *de tête de la reduction*, *premier Montréal*, *Québec*, etc. ; *deputé-ministre* for *chef du bureau au ministère ; il est rumeur que* for *on dit ; hydrant* for *borne-fontaine ; hose* for *boyau ; plant* for *le matériel*, *outillage ; collecteur* (collector) for *garcon de recettes ; adresser une assemblée* for *haranguer*, *faire un discours*, *porter la parole*, *adresser la parole*, *s'adresser à une assemblée ; lecturer* for

faire un discours; l'attraction de la semaine instead of *l'attrait*, etc. [this Anglicism has also made its appearance in France]; *damme* (dam) for *digue, barrage artificiel; bris de promesse de mariage* for *rupture*, etc.; *baronnesse* for *baronne* [*baronnesse* was used in France in the XV. century]; *assaut* (assault) for *attaque; plastrage* for *plâtrage; plombeur* for *plombier; site* (site of a building) for *siége, emplacement; comité de santé* (board of health) for *commission d' hygiène; medecin de santé* (health officer) for *hygièniste public; connexion, connection*, for *raccordement* (in speaking of *train* connections); *tramps* for *vagabonds*. These are only a few of the Anglicisms to be met with in the columns of the press. Among the advertisements you will come across such specimens as *grocerie, groceur* for *épicerie, épicier; gauts de kid* for *gauts de chevreau; briques à feu* (fire bricks) for *briques réfractaires; il y a une belle ouverture* (there is a fine opening) for *une belle occasion s'offre, il y a une bonne chance de réussite; notice* for *avis;* and a very large number of others.

The members of the bar are great offenders against the purity of their mother tongue. Here are a few examples of legal Anglicisms:—*rêferer à la file* for *consulter la liasse; identifier* for *constater l' identitè; commenter le presentement* for *commenter le rapport; grand jury* for *jury d'accusation; petit jury* for *jury de jugement; je crois avoir satisfait le tribunal* for *je crois avoir prouvé au tribunal; je suis satisfait* for *je suis convaincu, persuade; boîte aux temoins* for *la barre, barre du tribunal; boîte aux coupables, accusés* for *banc des accusés, prèvenus; filer une application* for *déposer*, etc.; *le terme de la cour est clos* for *la session*, etc.

In commercial life the number of Anglicisms is legion. M. Lusignan informs me that nearly all the terms in use in factories and workshops are English, and that the same is true of nautical terms employed on the St. Lawrence. Some other Anglicisms to be met with in the commercial world are:—*rencontrer un billet* (to meet a note) for *payer un billet, faire face à, acquitter*, etc.; *lettre enregistrée* for *lettre chargée; je collecte mes comptes* for *je fais mes recouvrements, je vais faire mes rentrées; transiger des affaires* (transact business) for *faire des affaires; changer, èchanger, casher une cheque* for *encaisser*, etc.; *maller une lettre* for *mettre une lettre à la poste; billet promissoire* for *billet; investir* (to invest) for *placer; investissement* for *placement; acheter en approbation* for *acheter a l'épreuve, a l'essai; très payant* for *très lucratif.*

In the Dominion House of Commons Anglicisms occasionally drop from the lips of honorable members from Quebec, and I think the worst specimen I have met with has been heard in Ottawa more than once: *moi pour un* (me, for one) for *pour moi*, *quant a moi*, *en tant que j' y suis concerné*, etc. Then we have *l'année fiscale* for *l'année financiere ; rappeler une loi* for *rapporter une loi ; voteur* for *votant*, *électeur ; les argents publics* for *sommes*, *deniers*, *crédits publics ; un réglement est en force* for *un réglement est en vigueur ; supporter* for *appuyer ; dépêche des affaires* for *discussion*, *examen*, *prise en consideration*, etc. ; *membre* for *député*, *représentant ; résumer le debat* for *reprendre le debat* [*résumer* = to analyse ;] *etait opposé par les deputes* for *etait combattu*, etc. ; *législater* for *légiferer ; faire application* for *demander*, *solliciter*, *soumissioner ;* and many others.

Before proceeding further I may as well state that the above division into classes is merely for convenience of reference, and does not preclude the possibility of an Anglicism quoted under one heading being classed under one or more of the others. In addition to the Anglicisms already given, I will quote the following miscellaneous ones: *indictement* for *acte d' accusation* ;[1] *qualification* is used in the same sense as in English, instead of *capacité*, *aptitudes ; billets complimentaires* for *billets de faveur ; aller faire prendre un portrait* for *aller faire faire*, *aller faire tirer un portrait ; sous ces circonstances* for *dans ces circonstances ; je vous observe que*, *je vous remarquerai que* instead of *je vous fais observer que*, *je vous ferai remarquer que ; un bloc de maisons* for *un paté de maisons ; dépôt* for *gare*, *station*.[2]

With the view of gaining as much information as I could about the use of Anglicisms in Quebec, I opened up a correspondence with the gentlemen mentioned in the beginning of this paper. M. Lusignan, before replying, submitted the letter I wrote to him to a club of leading French Canadians in Ottawa, to see whether their views coincided with his own. My first question was: "Is the use of the English language increasing or decreasing among the French Canadians of the Cities of Montreal and Quebec?" The reply to this was :—

(1) This word, although borrowed by the French-Canadians from the English, is found in Old French. It is going out of use in Quebec.

(2) This last example is a curious instance of a word being borrowed by the Americans from the French, and employed in a sense very different from anything for which it is used in France, finding its way back into the vocabulary of a French speaking people with its new meaning. It is not likely to live for any length of time, for educated French Canadians are waging war against it.

1. "The knowledge of English is increasing among the French Canadians of these two cities; it is almost general in the case of men and children.

2. Its use is more extended, owing to the growing importance of business interests and the increase of population.

3. The French Canadians do not make greater use of it in their intercourse with one another.

4. The language is more carefully taught in educational institutions."

To the second question: "Do the working classes mix many English words and expressions with their French?", the reply was: "Yes, a great number. All nautical terms from Ottawa to Gaspé are English, and English, or Anglicised French, is used in the lumbering operations. Nearly all the terms used in factories and in the various trades are English. The number of Anglicisms is legion, even in the press and among members of the bar."

My last request was for information about literature bearing upon the subject. M. Lusignan gave the names of several works, but stated that they were out of print and not easily obtained. He informed me, however, that M. L. Fréchette is preparing a work on the French of Canada, but that it would be some years before it is completed.

I next wrote to Mr. Robert Sellar, editor of the Huntingdon *Gleaner*, and his reply is all the more valuable when the fact is taken into consideration that, not being a French-Canadian, race prejudice cannot possibly bias his views. He stated that to the best of his knowledge "English has no leavening influence upon French as written in the Province of Quebec; that French writers give point to what they say by occasionally quoting an English phrase or maxim; and that in writing upon mechanical or business subjects they frequently use English words." He gave an instance, clipped from a French Canadian paper, which I will quote: "La police de toutes les villes voisines fut immédiatement avertie, et on espère reprendre l' évadé vu qu'il porte une marque difficile a cacher; un *black eye* des mieux conditionnés que Mackie lui fit en le capturant."

Mr. Sellar further stated: "The habitants have incorporated many English words in their vocabulary for the reason that the English term is shorter than its equivalent in French." I asked him

whether he thought there was any likelihood of English ultimately becoming the spoken language of Quebec. He replied: "There are probably three or four times as many French Canadians who speak English as there were twenty years ago, but they do not use English in speaking among themselves. They find that it is to their interest to learn English, that they cannot get on in the world unless they do, and they show a laudable eagerness to acquire the coveted language. Parents sacrifice a good deal to send their children to English schools, and one of the attractions of the so-called colleges and commercial academies that have sprung up so thickly within the past dozen years is that they teach English. The French have the faculty of language in a marked degree, and learn English with a facility that is astonishing to the Anglo-Saxon. In another century, perhaps a shorter period, the French of Quebec will be described as a bi-lingual people, but that they will cease to use their mother tongue I consider improbable. My reasons for such conclusions are:—

1. "The natural, the divinely implanted love for one's mother tongue.

2. The influence of the clergy and the politicians.

3. The disappearance of the English element from the rural parts of Quebec.

4. The existence of a sufficient mass of French-speaking people to resist outside influence. When you find a body of over a million, compact and autonomous, it is absurd to expect that they will change their speech."

In addition to the reasons already given for the continued use of the French language by our fellow-citizens in Quebec, there is another very important one. There is a determined effort being made by the literary men of Quebec to free their language, as much as possible, from the Anglicisms at present in common use, and this effort is meeting with considerable success. M. Lusignan's censorship in the columns of *La Patrie* is most evidently exercising a decided influence upon the French of the daily press.

Canada has no reason to be ashamed of her French Canadian authors. Two of them have already enjoyed the honor of being crowned by the Academy of France. L. H. Fréchette, Cremazié, Benjamin Sulte and L. Pamphile LeMay are French Canadian poets all marked by purity of style, excellence of verse, and an intense

patriotism. Dr. Larue and Ernest Gagnon have distinguished themselves as ballad writers, Garneau and Abbé Ferland are no mean historians, and I might give you the names of many other French Canadians who are aiding in building up a national literature; for the writings of our French-speaking fellow-citizens are Canadian in every sense of the word. We must no longer labor under the delusion that the French Canadians speak a mere patois or jargon of archaic and Anglicised French. The language spoken in Quebec is little else than the French of Racine and Voltaire, enriched by many words and expressions created and employed to express things peculiar to the country and its climate.

United by the triple bond of faith, speech and customs, the people of Quebec are not likely to fall an easy prey to our own aggressive mother-tongue. When it is taken into consideration that they are ministered to by priests who speak the purest of French, it is easy to understand how it is that they manage to withstand so successfully the influence of intercourse with ourselves. In fact, in many instances, Lower Canadians of Anglo-Saxon origin have become as French as their neighbors. Prof. Elliott, of Johns Hopkins University, says in the course of an interesting article on the French in Canada:—"As a natural effect of this rapid increase in population we find a gradual uprooting of the weaker race in point of numbers, that is to say the English. The wonderfully absorbing power of the French element in Lower Canada has here produced the curious phenomenon of a people, in certain parts of the country, who bear all the racial characteristics of the English or Scotch, such as blue eyes, light hair, florid faces, and who have the names of Warren, Fraser, McDonald, McPherson, etc., but also are still unable to speak a word of the mother tongue. The English names of roads, of towns, of counties, give abundant proof as to who were the occupants of the soil a few years ago. To-day it is the offspring of the Gallic stock that possesses the land. Their unswerving purpose, encouraged by the clergy, is to take back their old domains by the peaceful process of repopulating them with descendants of their own blood, and, at the present rate of increase, we may safely predict that it will not be many generations before they shall have accomplished this unique feat."

It is hardly the place in a paper like this to touch upon the political side of the subject. It is a significant fact, however, that

the French Canadians, in spite of all manner of obstacles thrown in their way, have succeeded in having their own tongue placed on an equal footing with ours in the Dominion Parliament and the Supreme Court.

I have not touched upon the influence of English upon the language of the French Canadians in the New England States, where they are placed under very different conditions to those which exist here. The fact is, I have had neither time nor opportunity to gather many facts bearing on the matter. From what little information I have been able to obtain, it seems that, in many instances, the French Canadian in the United States has become so far Americanized as even to translate his name. Thus we find Lenoir, Leblanc, Lebrun, etc., metamorphosed into Black, White, Brown, etc.

I will close this paper with a quotation from Louis Fréchette's "Pêle Mêle," where he is speaking of Jolliet and the old French pioneers who laid the foundations of civilization in our noble Dominion :—

"Et toi de ces héros généreuse patrie,
Sol Canadien, que j' aime avec idolatrie,
Dans l' accomplissement de tous ces grands travaux
Quand je pèse la part que le ciel t' a donnée
Les yeux sur l' avenir, terre prédestinée,
J' ai foi dans tes destins nouveaux."

Report of the Biological Section.

HAMILTON ASSOCIATION,

SEASON 1890–1891.

A. E. WALKER, Esq., *Chairman.*

THOS. WM. REYNOLDS, M. D., *Secretary pro. tem.*

The work of the Section during the past season has in spite of many difficulties been carried on with a very fair amount of success, and the interest that characterized former meetings has still been maintained. The great difficulty that has been encountered has been the removal from the city of some of the prominent workers, a loss which has been particularly felt, coming so soon after Dr. Burgess' removal. The members referred to are J. Alston Moffat and A. W. Hanham. Both gentlemen have rendered valuable services to the Section, especially in Entomological work. Mr. Hanham was perhaps best known by his work in Conchology, to which he devoted great attention of late; he was also at the time of his leaving the city Secretary of this Section. His place as Secretary has for the time been filled by the election of Dr. Reynolds. While we regret the loss of these members, there is, we are pleased to say, an influx of new workers, while a number of our old members are still with us and rendering valuable aid. Mention must be made of the many interesting notes on all branches of Natural History that have been furnished by Mr. Yates, of Hatchley, a corresponding member of the Association, whose name is well known to readers of our Transactions. During the summer of 1890, as in that of 1889, the members held their meetings at the residence of Mr. Alexander, and spent several pleasant and profitable evenings. Mr. Alexander has also furnished the Section some interesting notes on the Flora of his summer residence amongst the islands of the Georgian Bay. As intimated, through the exertions of Mr. Hanham, who has been

greatly assisted by Mr. George Leslie, a large addition has been made to our list of Shells for the district. Mr. Alexander has also made extensive additions to the Herbarium. In addition to the series of notes by Mr. Yates, presented from time to time, many other papers and items of interest have been brought forward, notably a paper by Mr. J. B. Turner on the Anatomy of Birds, and one on Comparative Forms of Animal and Vegetable Life, by Mr. A. E. Walker. During the coming summer it is expected that good work will be accomplished, and as many field days as possible will be organized in addition to the other work that may be done.

REPORT ON CONCHOLOGY.

Since May 1st, 1890, the following species have been added to the Hamilton List :—

ZONITES INTERTEXTES, *Binney*.

Taken by Geo. M. Leslie, May 24, 1890.

ZONITES MULTIDENTATUS, *Binney*.

Taken by Mr. A. W. Hanham, Nov. 6, 1890.

ZONITES FERRUS, *Morse*.

Taken Nov. 6, 1890, by Mr. Hanham.

ZONITES BINNEYANNUS, *Morse*.

Taken by Mr. Hanham.

HELIX PULCHELLA VAR. COSTATA.

Taken April 21st, 1891, by J. H. Lemon.

LIMNÆA COLUMELLA (?)

Taken by Mr. Hanham.

LIMNÆA REFLEXA, SAY.

Taken by Geo. M. Leslie.

LIMNÆA ———.

Two specimens of a *Limnæa*, taken by Mr. Hanham, are likely to prove new.

Considering the small number of collectors, this is a good showing for one year's work.

The taking of *Helix pulchella Var. costata* is of much importance, as I think this is its first appearance in Canada.

Besides the finding of these new species much other work has been done.

Our *Limaxes* have been identified as

LIMAX AGRESTRIS, *Linn.*

LIMAX CAMPESTRIS, *Binney.*

TEBENNOPHORUS CAROLINIENSIS, *Bosc.*

Specimens of a *Zonites*, taken in 1890, have been identified as *Zonites suppressus (Say.)* and more specimens have been found.

Several good specimens of *Unio Subovatus* have been taken from Hamilton Bay. This species was added to the list on the strength of a few detached valves, but is now fully entitled to be recorded. A large specimen, taken August 23, was alive. This is the only live specimen taken here.

Mr. Hanham, during the summer of 1890, took several shells which are very rare here, and so strengthened their records very much.

A considerable number of dead shells of an *Amnicola*, which is considered by Mr. Pilsbury to be a new species, has been taken, and it is hoped that some good specimens will be found this summer. Mr. Hanham took the first specimen in 1889.

Last year several searches were made in localities which were quite new, and always yielded something interesting or new. It is hoped that the same will be done in 1891.

After a storm in the spring of 1890 Mr. Hanham collected a very large number of shells which had been cast up from the Bay. It was hoped that a like opportunity would present itself in 1891, but such was not the case.

GEO. M. LESLIE.

The following is a list of the shells which have been taken up to date in this District.

TERRESTRIAL.

1. Limax agrestris, Linn. Common.
2. " campestris, Binney. "
3. Tebennophorus Coroliniensis, Bosc. Common.
4. Zonites fuliginosus, Griff. Rather rare.
5. " intertextes, Binney. Rare.
6. " nitidus, Müll. Common.
7. " arboreus, Say. "
8. " radiatulus, Alder. Not common.
9. " indentatus, Say. Rare.

10. Zonites indentatus, Var. This is the variety with the open umbilicus. Rare.
11. " minisculus, Binney. Rare.
12. " ferrus, Morse. Rare.
13. " exigius, Stimpson. Rare.
14. " multidentatus, Binney. Rare.
15. " fulvus, Drap. Common.
16. " milium, Morse. Rare.
17. " Binneyanus, Morse. Rare.
18. " suppressus, Say. Rather rare.
19. Helix (Patula) alternata, Say. Common.
20. " " perspectiva, Say. Rare.
21. " " striatella Anth. Common.
22. " " lineata, Say. Scarce.
23. Punctum Pygmæum, Drap. Scarce.
24. Helix (Mesodon) Throides, Say. Common.
25. " " albolabris, Say. Common.
26. " " Sayii, Binney. Rare.
27. " (Stenotrema) monodon, Rack. Uncommon.
28. " " " Var. Fraternum, Say.
29. " " " Var. Leaii, Ward. Rare.
30. " (Triodopsis) tridentata, Say. Common.
31. " " palliata, Say. Rather rare.
32. " (Vallonia) pulchella, Müll. Common.
33. " " " Var. costata. Rare.
34. " (Strobila) labrynthica, Say. Rare.
35. Pupa fallax, Say. Common but local.
36. " corticaria, Say. Rare.
37. " armifera, Say. Common but local.
38. " contracta, Say. Rather common.
39. " milium, Gould. Rare.
40. Vertigo ovata, Say. Rather rare.
41. " ventricosa, Morse. Rare.
42. " pentadon, Say. Rather common.
43. Ferussacia subcylindrica, Linn. Common.
44. Succinea avara, Say. Rather common.
45. " obliqua, Say. Common.
46. " ovalis, Gould. Common.

FRESH WATER MOLLUSCA.

47. Carychium exigium, Say. Common.
48. " " " Var. Exilis Lea. Common.
49. Limnæa stagnalis, Linn. Common.
50. " palustris, Müll. Common.
51. " humilis, Say. Common.
52. " desidiosa, Say. Common.
53. " caperata, Say. Not common.
54. " gracilis, Jay. Rare.
55. Physa gyrina, Say. Common.
56. " heterostrophia, Say. Common.
57. Bulinus hypnorum, Linn. Common.
58. Planorbis campanulatus, Say. Common.
59. " trivolvis, Say. Common.
60. " bicarinatus, Say. Common.
61. " albus, Say.
62. " deflectus, Say.
63. " exactus.
64. " parvus, Say.
65. " nautileus, Linn. Rare.
66. " armigerus, Say.
67. Ancylus rivularis, Say. Rather rare.
68. Valvata tricarinata, Say. Common.
69. " sincere, Say. Common.
70. Melantho decisus, Say. Common.
71. Amnicola limosa, Say.
72. " " var. pallida.
73. " Cincinnatiensis.
74. " sp.
75. Pomatiopsis Lapidaria, Say. Rather common.
76. Pleurocera Subulare, Lea. Common.
77. Goniobasis livescens, Menke. Common.
78. Sphærium Sulcatum, Lam. Common.
79. " rhomboideum, Say. Rare,
80. " truncatum, Linsley. Rare.
81. " partumeium, Say. Not common.
82. " stramineum. Common.
83. " occidentale. Common.
84. Pisidium abditium, Prime.

85. Pisidium compressum, Prime. Rare.
86. Unio alatus, Say. Rare.
87. " gracilis, Barnes. Rare.
88. " gibbosus, Barnes. Rare.
89. " complanatus, Sol. Common.
90. " Nasutus, Say. Common.
91. " Luteolus, Lam. Common.
92. " subovatus, Lea. Rare.
93. " pressus, Lea. Common but local.
94. Margaritana marginata, Say. Rare.
95. Anodonta ovata, Lea. Rare.
96. " plana. Common.
97. " Benedictii, Lea. Common.
98. " fluviatilis, Dillwyn. Common.

NOTES ON DOMESTIC ANIMALS.

Read before the Biological Section.

BY WM. YATES, HATCHLEY.

Some years ago we remember being much interested in reading an article in Dickens' *All the Year Round*, under the heading "What Horses think of Men." To get at a true surmise of the condition of animal intelligence the thesis seemed to us to start at the right point, and to people whose business it is to have the care and training of farm animals there were useful suggestions to be gleaned from its perusal.

A majority of our farmers take much pride in dilating on the grand qualities and accomplishments of the horse, and the charm that the education of the horse is known to have for our tillers of the soil seems to be that that animal is amenable to judicious treatment, and that his disposition and idiosyncrasies are a reflex image of those of the human being, to whose management and tutorship his "breaking in" has been intrusted; and also that the intelligence of the animal is capable of being usefully modified and extended by gradual and repeated incentives to the obedience of a superior will.

We think that it can also be shown that the bovine race are nearly as plastic and impressionable from exterior sources as are their equine associates of the field or barnyard, and, in fact, the assumptions apply with greater or less truth to nearly all the tribes and classes of inferior animals.

In the course of a number of years of observation and familiarity with the habits, instincts and behaviour of the bovine tribe as exemplified in the pastures and in the cattle byres, we have become convinced that these latter possess strong claims to more than a glimmering of reason, and that in a rudimentary form the workings of those higher brain faculties, that are sometimes exclusively claimed for human beings, are not unfrequently demonstrated by cows and oxen. We feel quite sure that they are not only capable of drawing the plough and the harrow, but that they can draw *inferences* too, and are sometimes far from slow at taking a hint, and

this sometimes, not to the benefit or exclusive interest of their human proprietors, in fact they are rather apt sometimes to improve on his teaching and to carry the *morale* of his tuitions beyond the point of strict economics and strict regard to the thriftiness of field crops.

In their emotional natûre, too, we may see that they display more than a faint copy of semi-human traits. In their devotion to their young offspring—in their sympathy with each other in moments of danger—in their demonstrations of hope, fear, indignation and reyenge they give evidence of a long memory and an invariable inclination to pay off old scores. In fact there would seem to be no reason to doubt the rationality of brutes—that is, their capability of inferring results from past experience.

In brutes, as in human beings, there is a gradual accumulation of experience, beginning at the zero level of birth, and culminating in a degree of sagacity that keeps the inventiveness of the stockman on the alert to baffle and out-manœuvre. The young calf has not only instinct, but an inquiring gaze may be noticed in its eyes on the approach of a moving object, and its mental acquisitions ascend through a scale of faculties that seem identical with those of psychological growth in a child.

In the adult ox or cow we can see a change of attitude and plan of operations, in conformity with a change of surrounding circumstances, and they have much self-will and adaptability in overcoming opposing influences.

Hunger and thirst are the impelling energies of their lives—and in the animal world the whole tuition of seniors seems to consist in imparting to the young the knowledge of *what to seek and what to avoid*. They teach them *not* to trust to appearances, that the world is full of snares and illusions, and that eternal vigilance and suspicion is the price of safety. This is more obviously true of wild or semi-wild animals, and cattle that roam the wild woods are much more noted for cunning and acuteness and abundance of resources than such as are waited on and regularly fed by the stock-keeper.

A well known source of expense and trouble to the farmer is the tendency of animals to jump over or to break down fences. This quality is called "*breachiness*," and animals that have a strong tincture of the propensity get a bad name, and are deteriorated in value. They learn this trick by degrees. Sometimes, when chased

by a dog, to escape the danger and worry, they will spring at a fence that in their normal mood would securely confine them in their accustomed bounds, but perhaps the rails break or are thrust aside, and the breach opens to them "fresh fields and pastures new." This is a discovery and a revelation that is sure to be utilized in the future life scheme, and by the force of example is communicated to the less adventuresome members of the herd.

We may as well attempt to illustrate what we have been just advancing by relating incidents in cattle life that occurred within range of our own experience.

The pair of oxen by whose help we cleared up, logged, fenced and ploughed 30 to 35 acres of wild bush land, were of average size, intelligence and quality, but we have only space and leisure to jot down a few of their peculiarities and exploits. Their behaviour towards each other as life associates and yoke-mates, and sometimes rivals, was a delightful study, and almost always as entertaining as a comedy in real life. We named them Dick and Diamond. In ox-teams one is usually the master spirit, and this one the custom of the country tries to place on the off-side. In our case this was "Diamond." He was rather the smaller as to size and brawn, but had a demoniacal temper when aroused, and had a most formidable and bison-looking frontispiece. The nigh ox was a symmetrical and handsome bovine, gentle and placid and noncombative in disposition, and when *unyoked* deferred and yielded subserviently to his despotic companion. Both were nearly of the same color—a light red. One of their escapades, if correctly described, will better show their relative mental status than a lot of definitions. To "Diamond" dame rumor, at the time of our purchase of the team, had affixed a slight stigma of "breachiness," but not of a very confirmed type, *i. e.*, 'twas said that he had'nt yet acquired the proficiency of throwing down *good* fences, but that he was an adept at jumping ordinary ones, so we took the precaution of surrounding two acres of rich meadow with a strong and high stake and ridered fence for the team's special use, but after some time we were disagreeably surprised one morning to find both Dick and Diamond knee deep in clover in the field next their proper allotment. They both pretended not to know the way out, and we were obliged to lower the rails of one panel almost to the ground level before we could oust the trespassers. But after much search

we found where two or three rails had been displaced and whence the *sortie* had been made. The fence was repaired and strengthened, and for a time all went smoothly until, on a certain morning, on going to "yoke up" we found that Dick was crippled and incapacitated for work by an injury to his hind quarters; there was much swelling and lameness, and the cause—a mystery! We caused the invalid to be examined by one in the locality who had a reputation for veterinary knowledge, but all he could say was, that the swelling at the base of the abdomen was the result of violence, perhaps of jumping, and that the animal had alighted astride of the fence or a stump, (these were numerous). However, the inconvenience soon passed off with rest, etc., and we had ceased to think of the matter, but we soon noticed in the evenings, after our day's logging was done, and unyoking in the pasture had taken place, the buffaloes did not begin to graze or ruminate, but seemed agitated and restless, and the question arose, what could be in the wind now? "Diamond" would look vacantly skyward and give a longing low or two, and then lick his shoulders, where the yoke might perhaps have rubbed and chafed him; "Dick" looked puzzled and expectant, standing still at a little distance, and closely watching his ill-natured mate! We thought the farce worth watching, and stayed quietly in a secluded spot for an hour or more to find out what the *denouement* might be. After some time "Diamond," with treachery in his mien, advanced a few steps towards his somewhat timorous but colossal-sized mate, but the latter moved on, still deliberately followed by "Diamond." With both the pace became an accele ated one all around the small field, pursuer and pursued; after a number of perambulations "Diamond" having gotten his terrified "pard" just where he wanted him, i. e., in a corner, made a roar of triumph, and with a mighty lunge, sprang on to poor trembling "Dick," goring the latter unmercifully, whose only chance of escape from the dilemma was to charge the high fence like a battering ram, which of course gave way before this irresistable onset, and the pair were once more in the clover blossoms, "Diamond" no doubt chuckling at this repeated successful result of his "*ruse de guerre*."

So here was the wished for explanation of the mysterious swellings and lameness that had lost me several days' use of my team in seeding time, and caused me a journey in quest of the cow-leech.

After this experience I found it necessary to give this pair of bovines the closest surveillance both by night and by day, and by so doing extracted much help and benefit from their many years of service and usefulness, and I parted with these companions of many happy hours and laborious, sweat-producing days, with sincerest regrets.

It was an invariable rule with " Dick " in the later part of his career, when unyoked at the end of his day's work, to stand at a distance of about twenty yards from " Diamond," and *not to lie down uutil the latter had done so*, and then to lie down at a distance, with his head towards his evil genius, whose every movement had to be guarded against.

Report of the Geological Section.

To the President and Members of the Hamilton Association:

In submitting this report the Section desires to intimate that the usual interest in the work done by the members during the past year has been maintained.

Since the removal of the Association from the Alexandra Arcade to the more comfortable apartment in the new Library Building, we have enjoyed our meetings more thoroughly than formerly, and are pleased to state that our membership has increased.

With the exception of the three months required for moving and fitting up, we have had a meeting every month, at which papers of more than usual interest were read, excepting January, 1891, when we adjourned after the preliminary business was completed. The Chairman, Col. C. C. Grant, has been most indefatigable in his exertions to make these meetings a success.

Through the Chairman and Mr. A. E. Walker, the attention of the members has been specially called to the discoveries of new forms and species of fossil sponges and stromatoporæ, of which a liberal donation has been made to the Museum.

Following are the names of the papers, authors, and dates on which they were read:—

Fossil Stromatoporidæ, by Mr A. E. Walker, May 23rd, 1890.

Cœlenterata and notes on Burlington Heights, by Col. C. C. Grant, June 27th, 1890.

Asteroidea, Living and Fossil, by Col. C. C. Grant, July 25th, 1890.

Indian Ossuary at Burlington Beach, by Col. C. C. Grant, Nov. 28th, 1890.

Marine Annelids, Errantia and Tubicola, by Col. C. C. Grant, Dec. 26th, 1890.

Irish Celts and their Relics, Part I., by Col. C. C. Grant, Feb. 27th, 1891.

Irish Celts and their Relics, Part II., by Col. C. C. Grant, March 27th, 1891.

Irish Celts and their Relics, Part III., by Col. C. C. Grant, April 24th, 1891.

C. C. GRANT, *Chairman.* A. T. NEILL, *Secretary.*

STROMATOPORIDÆ.

Read before the Geological Section, May 23rd, 1890,

BY A. E. WALKER.

The subject for our consideration to-night will be those obscure fossil forms belonging to the genus Stromatoporidæ, of which there are innumerable species, which have caused so much discussion to all palæontologists, in fact a perfect zoological stumbling block so far. At first sight they much resemble Eozoon Canadense, but their mode of fossilization and structure are remote; they have be n referred to as corals, sponges, foraminafera, and even to hydractiniæ, based probably on an imperfect acquaintance of the microscopic structure of these forms. In the first place, it is extremely difficult to get these fossils so well preserved as to show their true structure. They are dense, compact forms, and the slow process of infiltration of the silicates or carbonates gives time for these deposits to recrystallize, and in a measure to destroy their delicate structure. This is most particularly the case with those found in the Niagara formation, and in the Guelph. These forms commence in the lower Trenton, and follow up through the Hudson River, Clinton, Niagara, Guelph, and through the Devonian. I am not aware of their being found in the Carboniferous, as I have had no opportunity of examining any of the later formations.

In the year 1879 I sent a specimen to Sir J. W. Dawson, from the corniferous limestone of Marble Head, Ohio, which was most beautifully preserved; the concentric laminæ and pillars are in the condition of opaque calcite, apparently retaining its minute structure, and not affected by crystallization; the interspaces or chambers are occupied by transparent calcite, permitting all the structure to be very well seen, either on polished surfaces or transparent slices. It was from this specimen that he published his report of the microscopic structure of stromatoporidæ idea, which I place before you. "It is evident that the animal matter of the stromatopora must have occupied the chambers and interspaces, and must have extended from chamber to chamber, also through the pores and hollow pillars.

Such a structure is obviously that of a rhizopod rather than that of a sponge. Further, the arrangement of the laminæ and pillars is very nearly allied to the Parkeria and Loftusia, as described by Carpenter and Brady."

I am here quoting Dr. Dawson's remarks. He further says:—"The supposed oscula on which has been based a reference of these forms to sponges are certainly not constant. Although these forms have a strong resemblance to Eozoon, the main structural difference is that while Eozoon has a delicately-tabulated proper wall of nummuline tpye, that of stromatopora has coarse perforations and pores." In the great Niagara limestone, as seen at Niagara Falls, the masses of stromatopora occur precisely as Eozoon occurs in the Laurentian limestones, and are mineralized with quartz and dolomite, and often converted into crystallized masses void of any structure. The first general impression was, that these forms belonged to the family of the sponges, the idea being that the lateral pores and openings were the inhaling, and that the perpendicular tubes and pores and vermiforn star-like openings were the exhaling oscula. These are distinctly seen in those classed as Cœnostromæ, and in Caunopora Walkerii, also in Caunostroma Restigouchense and others; still there are other forms which show nothing that can be considered as an osculum. It would seem that they cannot be classed with the foraminifera, as they show no pure nummulitic wall. Yet I think that Dr. Dawson and Carpenter lean to this view. There also seems a difficulty in placing them with the sponges. Why not place them with the Hydrocorallinæ, or Milleporæ? These forms build or deposit on other forms layer by layer, as does the stromatopora, and the tubules in the laminæ of the Millepora Alcicones have much resemblance to the former. There are structural differences, but we find the most extraordinary differences in the many forms of stromatoporæ. Although the forms of the Milleporæ of the present day may be much modified from the ancient type, it is no greater than what we find in other forms. If they should be found to belong to the Hydrocorallinæ, they are existing at the present day in great masses on the coral reefs and attached to shells, seaweed or other forms, as did the stromotopora of old. I have found the stromotopora enter by enveloping a favorite, also entirely surrounding a group of Diphyphyllum and other corals, also surround-

ing an Orthoceras. I have lately found one form of stromotopora entirely enclosing another.

As this subject is still under consideration by many specialists, I shall not give you more than the few remarks already made, but will show you specimens of Eozoon, Loftusia, Milleporæ and many forms of stromatoporæ from the Clinton and Niagara, of our own locality, and other forms from the Guelph and Devonian. You will be able to judge how they vary in structure; also, how obscure and poorly preserved some of them are. Although you will see many beautiful specimens, there are still many others belonging to the Niagara that I have not as yet obtained.

It would be as well, before we discuss these specimens, to get a general idea of their structure. This is what Sir J. W. Dawson says of a well-preserved specimen from the corniferous limestone of Ohio: "In these the concentric laminæ and pillars of the fossil in the condition of opaque calcite, apparently retaining its minute structure, and not affected by crystallization, and the interspaces or chambers are occupied by transparent calcite, permitting all the structure to be very well seen in transparent slices."

In these specimens about three interspaces and two laminæ occur in the space of a millimetre; and though neither the laminæ nor the interspaces are uniform in thickness, the latter are about twice the width of the former. In some places the laminæ rise into conical or rounded eminences with corresponding depressions; in others they are nearly flat and concentric, this difference being apparently accidental. The laminæ are connected with each other by pillars, which are either round or somewhat flattened. The texture of the laminæ is not spicular, but perfectly continuous and finely granular, as if made up of minute fragments of calcite. When the mass is broken parallel to the laminæ, the pillars appear as minute tubercles (but a true exterior surface is smooth.) The laminæ are pierced with numerous round pores about one-tenth of a millimetre in diameter. Some of these pass through hollow pillars across one interspace into the next. The laminæ themselves are here and there pierced with horizontal tubes, which thicken the laminæ where they pass; they appear to traverse the laminæ obliquely from one space into another, or from the hollow pillars laterally. They may be called canals. In addition to the ordinary laminæ, some of the chambers or interspaces are sub-divided by very thin secondary lam

inæ. In a few cases these are attached to ordinary laminæ as a sort of inner wall. The ordinary laminæ in the more regular specimens are often of great continuity, extending without interruption for several square inches.

The above is an accurate description of the most common type of stromatopora, when in its natural condition. I have a specimen here which I obtained from the Clinton, about half-a-mile east of the Jolley Cut. It is of parasitic growth incrusting a favosite; the entire form was some five inches in diameter, enclosing the favosite all but the under side in a hemispherical form, thinning out at the margins. It has been named by Professor J. W. Spencer, Caunopora Walkerii. He describes it in the following manner:—Laminæ thin and obscure with chambers entirely filled with supplemental matter, only occasionally traversed by short, tortuous canaliculi, connected with the vertical tubes. Vertical pillars connecting laminæ removed or obscured by the filling, but with numerous connecting pores apparent and filled with matter different from the rest of the mass. The organism is traversed by irregularly situated tubes producing orifices on the surface of about one-half millimetre diameter, and scattered over the surface from 2 to 4 mm. apart. The connecting pores are crowded together, and are apparently situated around centres, or sometimes around the larger tubes. These tubes extend down into the substance and appear to traverse several thicknesses of the laminæ. I have chosen these two forms described by Sir J. W. Dawson and Prof. J. W. Spencer from the fact that they are most divergent. Another form, Cœnostroma Antiquum, from the Niagara at Thorold, is an incrusting form, differing from all others of the class Cœnostroma from the fact that each group of tubulæ is separated by a thin layer of clay before the next was formed, showing that each group of tubulæ was of separate and independent growth; in other respects it differs but little from the other forms of Cœnostroma.

I might mention that these forms are found in the Dolomite limestone of Niagara and Guelph; in fact these forms are almost always associated with magnesian rocks, and are so abundant at times as to make up certain layers. The study of these forms was comparatively in its infancy until lately. I see that Prof. Nicholson and others have published a most elaborate work on these forms of late, most carefully illustrated; but as it is in connection with a

work that covers a number of years, I am afraid that it cannot be obtained separate from the other volumes.

There is no doubt but that we shall soon be able to place these forms in their proper order, and get a more correct idea of their mode of growth and reproduction. I do not myself feel competent to go extensively into this subject, which has puzzled so many wiser heads. I will now close these remarks, so that we may have an opportunity to discuss the following specimens I have here from the

NIAGARA FORMATION.

Stromatopora,	concentrica, Goldfuss.
Cœnostroma,	constellatum, Hall.
Dictyostroma,	undulatum, Nicholson.
Cœnostroma,	botryoideum, Spencer.
"	restigouchense, "
"	antiquum, Nicholson.
"	constellatum, Hall.

1 not named.

1 Concentrica inclosing coenostroma antiquum.

CLINTON FORMATION.

Stromatopora,	concentrica, Goldfuss.
Caunopora,	Walkerii, Spencer.

GUELPH FORMATION.

Cœnostroma,	Galtense, Nicholson.
Stromatopora	ostiotata, "
"	mammillata, "
"	substriatella, "

2 others, not named.

DEVONIAN FORMATION.

Cœnostroma,	densum, Nicholson.
Stromatopora	substriatella, "
"	granulata, "
"	nodulata, "
"	punctulata, "
"	tuberculata, "

2 forms unnamed.

NOTES ON BURLINGTON HEIGHTS.

Read before the Geological Section, June 27th, 1890.

BY COL. C. C. GRANT.

A young naturalist recently called my attention to a particular portion of the continuation of "Burlington Heights," which probably may, to some extent, have escaped observation. The locality in question is called "The Sand-pits," on the Dundas road. Here, under a shelving bank containing cavities in a bed of fine, loose sand, were obtained a large number of sub-fossil remains—teeth and bones of rodents, land snails, etc. I excavated the bed to a depth of ten inches or more. The sand had apparently fallen from overhead, covering up many successive generations of the fauna in question. I failed to obtain any specimens of fresh water mollusca or fish remains, but a few of the teeth bear rather a marked resemblance to some of the latter. They may, however, belong to some small land animal—a bat, for instance. Two are submitted for examination.

The caverns in the ridge were very likely known to the Indians, and possibly may have been frequented also by the fauna of the neighborhood. If so, we may expect to find their remains in good preservation, owing to the cementing materials—carbonate of lime, calc-sinter, etc.—which bind the gravels and sands together. These would envelope and preserve the specimens by excluding air and moisture.

Since the officials of the Grand Trunk Railway of Canada debarred the naturalists of our Association from their respective pursuits—not only along the line, but even inside the fences—the above locality may afford, at least some of us, a fresh field for research.

NOTES ON THE ASTEROIDEA, ETC., LIVING AND FOSSIL.

Read before the Geological Section, July 25th, 1890.

BY COL. C. C. GRANT.

My acquaintance with both living and fossil is so extremely limited that the Section must not expect to find much original matter in the brief notes I have taken. The information respecting this exceedingly interesting class is derived chiefly from the writings of European naturalists already known to you, or of scienitfic men in the United States on recent deep sea dredging expeditions.

In the Silurian rocks of Canada, including the specimens obtained in Anticosti a few years ago, I collected altogether a dozen true star-fishes. Some were in duplicate; one from the Clinton beds was described and figured by Dr. Spencer, now State Geologist of Georgia; four, perhaps five, I think, were new species; two were pronounced to be new forms of *Stenaster* and *Palasterina*, by the late E. Billings, who seems to have laid them aside so carefully that they have never turned up since his successor, Mr. Whiteaves, was appointed Palæontologist. However, a duplicate of one of them was forwarded to the Irish Geological Survey Office, Dublin, and as the parcel containing it was received by the late Mr. Bailey, I conclude it may be found in a museum case of Hamilton organic remains. It is so small that likely it may have escaped observation. The living star-fishes, not only the ones usually found on reefs and in shallow water, but also at great depths, possess almost as varied an assortment of colours as the mollusca themselves. In the "Cruise of the Blake" the younger Agassiz states:—"Colonies of ophisthrix may be found on the flats and keys of the Gulf (Mexico), blue, green and red, while here and there a yellow or vermillion star marks the soft ophomexa flaccida. These and their companions, living in a strong light and in warm shallow water, present brilliant and well marked colors—nor are these that inhabit the depths of the ocean always pale. On the contrary many are bright orange and red. The colors of these, however, do not appear

to be fixed, for he adds, 'like other things from the ocean abysses, they likewise fade in alcohol.'"

A dried specimen of a modern star does not display the minute worm-like feelers, feet or suckers used both in locomotion and to seize prey. It can in an instant extend or withdraw them when living; they are hollow and each is connected with a globular sac, containing fluid, within the body of the animal. At the will of the star the vesicle contracts, forcing the watery matter into the corresponding sucker—a contraction of the sucker has an opposite effect. I noticed frequently how quickly it withdrew the feet on touching it.

The *Ophiuroidea*, or snake stars, furnished with long whip-like arms, have no true suckers. Some species have spines. They appear to depend on their arms solely for progression.

The *Euryales* we have not met on the Irish coast. Forbes, as well as I recollect, pronounces it very rare on the coast of Scotland. It is about a foot in diameter, and has peculiar branching arms, which it uses as a net to enclose its prey.

The *Brittle Stars* are said to be abundant on all the shores of Great Britain and Ireland. There are ten native species. The opheozoma rosula, a very beautiful one, displays splendid colors arranged in regular patterns. No two are coloured alike. The brittle star derives its name from an extraordinary habit it has of casting off its members when you touch it. E. Forbes found by plunging it suddenly into a bucket of fresh water it lost the power, and became paralyzed. The largest species are found in the Tropics.

The Asteriæ, stars with stellate body and flat rays, are ranged into a different group. One member, at least, goes even beyond the brittle stars, for it not only dismembers itself, but it breaks the arms into fragments as well. The following account is so quaintly given of the capture of "luidea fragilissima," you may perhaps forgive the quotation from Professor Forbes, Edinburgh: "The first time I ever took one of these creatures I succeeded in getting it into the boat entire. Never having seen one before, and quite unconscious of its suicidal powers, I spread it out on a rowing-bench, the better to admire its form and colors. On attempting to move it for preservation, to my horror and disappointment I found only an assemblage of rejected members. My conservative endeavors were all neutralized by its destructive exertions, and it is now badly

represented in my cabinet by an armless disk and diskless arm. Next time I went to dredge on the same spot I determined not to be cheated out of a specimen in such a way a second time. I brought with me a bucket of cold, fresh water, to which article star-fishes have a great antipathy. As I expected, a luidea came up in the dredge—a most gorgeous specimen. As it does not generally break up before it is raised above the surface of the sea, cautiously and anxiously I sunk the bucket to a level with the dredge's mouth, and proceeded to introduce luidea to the purer element. Whether the cold air was too much for him, or the sight of the bucket too terrific, I know not, but in a moment he proceeded to dissolve his corporation, and at every mesh of the dredge his fragments were escaping. In despair I grasped at the largest, and brought up the extremity of an arm with its terminating eye, the spineous eyelid of which opened and closed with something exceedingly like a wink of derision."

The *Common Cross-fish*, so destructive to oyster beds, is often dredged minus one of its five fingers. The fishermen suppose that it had incautiously inserted the lost member between the valves of the oyster, and had it amputated. This was proved to be a popular error years ago. The star smothers the bivalves by enclosing the valves until it is forced to open its shell. This statement of an eye witness bears out what Professor Forbes said on the subject in the main. The Professor seems to think, however, that the star fish may paralyze his victim by injecting a poisonous fluid. That perhaps may be erroneous. We must not forget at the same time, that the mytilus (mussel) proves poisonous at times, and medical experts attribute this to their feeding on the eggs of the stars. [A well-known writer for a paper in Dublin recently lost his wife and three children from eating mussels.]

The *Goniasters* I had nearly omitted altogether. They approach the sea urchins; the rays or arms are shortened. Many of the Bahama stars would recall this group to recollection, probably. Other Genera, recently established, are unknown to me. I have not seen the figures, and one cannot form a correct idea from description alone. As regards the fossil star-fishes of the Cambro-silurian and our local rocks, all I obtained were small, two were exceedingly minute. The Palasterina Jamesii of the Cincinnati group (Hudson River) is said to be four inches across. A *Tæniaster*,

figured by Dana, appears to be unusually large also, if the natural size is correctly given.

The *Petraster*, from the Niagara shale, described by Mr. Billings in the Proceedings of the Canadian Geological Survey, was found at Stoney Creek (not Grimsby), by my friend Johnson Pettit. A Cyclocystoides I discovered at Anticosti is in the Redpath Museum. It is not definitely settled as to whether it belongs to the *Asteroidea* or *Cystideans.*

NOTES ON AN INDIAN OSSUARY AT THE BEACH, HAMILTON, ONT.

Read before the Geological Section, Nov. 28th, 1890.

BY COL. C. C. GRANT.

I recently learned from a young friend of mine that an Indian ossuary or bone pit had been exposed in excavating sand and gravel on the spur of the new Grand Trunk Railway line at the Beach. Unfortunately I discovered others previously had an inkling of the matter, and it was only after several days spent in excavating the fine sand that I obtained clear proof that the part I had selected for my antiquarian researches had most undoubtedly been recently disturbed. However, as I noticed that some exceedingly small "wampum" appeared to have escaped the observation of the previous searchers, I came to the conclusion that it might be as well to work on and endeavor to ascertain the dimensions of the ossuary, and also if any part had, by chance, been unnoted by the earlier explorers.

The work of removing the sand itself is very tedious. When you get down about two and a-half or three feet, the water from the swamps and lake close by percolates through the former Beach, so you are compelled to excavate nearly knee deep in water, and the bones, wampum and relics are chiefly found about a foot below the surface of the water.

It strikes one as very strange that the Red Men should have selected such a low, swampy burial place. It was mentioned, I think, by one of the members of our Association, recently, that Lake Ontario was some two feet higher than usual this year. The circumstance may afford us some explanation of what at first sight seems difficult to understand. On the other hand, several old residents of this city have assured me that the water of the bay is considerably lower now than it was thirty years ago.

In the first circular pit I discovered, in addition to the wampum beads, a Spanish silver coin of Charles III., dated 1776. On exca-

vating beyond the edge I found a layer of undisturbed gravel. Several pits have been sunk by men and boys at various points nearer the railway track since I commenced operations—some few, indeed, before. One of the excavators informed me he found the skeletons regularly arranged in a circle, heads touching, feet outwards. These, I presume, were the bodies of such as had more recently died than others, whose remains were cast up promiscuously, as described in the paper by our President on "The Discovery of Burlington Bay."

I commenced a fresh excavation near the track, but was compelled to leave it for the present at least. I have obtained from it already some wampum, brass bracelets, much decayed, as might have been expected from their environment.

I was reluctantly obliged to postpone further researches until next year in consequence of cold weather setting in.

I think it probable that there are some undisturbed burial pits between the railway track and Mr. Lottridge's house. The gentleman in question obtained some years ago a remarkably fine collection of Indian relics from an ossuary close to his residence, together with a silver chalice, which I suppose belonged to one of the French Jesuit Missions. I understand Mr. Lottridge, quite recently, unearthed other Indian remains in putting down some fence posts not far from the place where I have been working.

NOTES ON CŒLENTERATA (ZOOPHYTES) AND RECENT CLASSIFICATION.

Read before the Geological Section, June 27th, 1890.

BY COL. C. C. GRANT.

Passing over still lower forms of life among the invertebrates, rhizopods, foraminifera and sponges, we come to a group called zoophytes, defined by Dr. Geikie as radically symmetrical animals with a body composed of cells, arranged in an outer and inner layer, including a body cavity, sub-divided into:—

Hydrozoa—including the fresh water hydra, the marine jelly fishes, millepores, campanularia, sertularia and the extinct graptolites.

Ctenophora—spherical or cylindrical medusæ, including Venus' girdle, and beroë—North Seas.

Actinozoa—polyps and actiniæ (sea anemones).

Rugosa—the older corals in which the calcareous partitions are arranged in multiples of 4 with transverse partitions. Zaphrentis, amplexus, cyathophyllum are examples.

Alcyonaria—including alcyonia, pennatula, gorgonia; animals with light plumed tentacles, calcareous bodies and horny skeletons.

Zoantharia (modern forms) tentacles, 6 or multiples of 6—star corals. Mushroom (fungidæ) madrepores.

Hydrozoa.—Although I am informed the fresh water hydra is found in Canada, I have never seen it in any stream or brook here. Indeed, I doubt if I ever saw it since I was a small boy. I was standing in a tributary to the Blackwater, in the County of Cork, Ireland, engaged in turning over the stones in the brook, hunting for loaches with a three-pronged fork I had surreptitiously secured from the kitchen, when I distinctly saw through the clear water what looked to be a plant stalk moving close to my feet like a looping caterpillar. The whole proceeding appeared so uncanny that I made such haste for dry land that I stumbled and plunged head-foremost into the brook, leaving my angling belongings behind me. Reflecting that the loss of the fork may lead to disagreeable enquiries, I was induced to make an attempt for its recovery as well as to

examine more closely the cause of the panic. Well, there on the very margin, depending from the branch of a plant, was another member of the family to which my unwelcome acquaintance belonged, fixed by the tail.

On relating my adventures to an old friend of my father's subsequently, he seemed highly amused, and told me what I thought was a plant was a live animal called "a hydra," that if its body was cut into small pieces, each after a short time became a complete animal. Then he informed me the name was derived from the myth of a serpent with many heads slain by Hercules—as fast as he cut them off they put in a fresh appearcnce.

The famous naturalist Louis Agassiz, was, I think, the first to transfer not only the graptolites but some of the lower forms of corals to the hydrozoa, while the elder Sars boldly asserted that the modern sertularia, tubularia, campanularia, commonly called "sea-wreaths," "sea-feathers," "sea-bells," all closely allied to graptolites, are merely alternating generations of the medusæ, that these hitherto supposed polyps and their numerous united families proceed from a single medusa larvæ, and that they in their turn produce complete and perfect acalephæ; that however unlike they may seem to be they are identical. Few of us, perhaps, may ever be afforded an opportunity of studying the lower forms of marine life. This, if it can be proved, seems very wonderful.

Several years ago the Italian naturalist Chamisso asserted of the linked salpa, composed of chains of individuals united, which glides like a snake through the blue water of the Mediterranean, every link a distinct animal, but moving as if actuated by a common impulse, and pursuing the same course as if controlled by a united will, that each separated link gives birth to a chain of linked individuals, while the chain itself produces but a solitary salpa. This extraordinary statement is now a well authenticated fact.

Graptolites.—Although it was known to many in Canada and the States that the local rocks of this city are rich in these remains, the circumstance does not appear to have attracted much attention elsewhere.

Dr. Spencer, F. G. S, in 1884 described and figured in the *Bulletin* of the Museum, Columbia (Mo.) University, several fossils from the neighborhood of Hamilton, previously unknown, including about thirty new graptolites, remarking that he was in pos-

session of some twelve others too imperfect for description. It is to be regretted that Professor Spencer ceased to hold the Chair of Geology in the Missouri University before the completion of the second volume promised, for I believe we could have furnished him with at least seventy additional species unknown on this continent, from our Niagara and Clinton beds. That would represent about twice the number discovered in the lower Silurians. Some naturalists, however, consider the graptolites to be more nearly related to the bryozoons. This opinion I think untenable. Even while admitting that it is a difficult matter indeed to classify the lower forms of life, our local chert beds contain numerous bryozoons. They are colorless in the matrix, with a solitary exception. Dr. Spencer figured and described the vein-like marking of *Rhinopora Venosa*, (which undoubtedly presents a black impression in the chert), as *a doubtful graptolite.* It was only after publication that we clearly ascertained the rest of the bryozoon presented precisely a similar appearance to the markings left in the chert by "retepora," "clathropora," "fenestella," members of the same group.

In all cases the true graptolites are stained and colored black with us. In a few rare instances the bituminous matter scales off when drying. It may not be out of place to remark that an erroneous idea prevails among palæontologists generally, viz: that these hydrozoa are usually found in shales, seldom in limestones. The very contrary seems nearer to the truth, I noticed both here and at Anticosti.

The *Medusæ* or jelly fishes of modern times are quite numerous on the south-west coast of Ireland. In their natural element they are very beautiful objects, although deficient in the rich coloring which a Tropical climate imparts to their more favoured family elsewhere. When cast ashore they have been described as disgusting slimy things which merely leave a thin coat on the strand when the body inflated by water disappears like a soap-bubble. Boys when swimming frequently find the contact with what we call sting-nettles very disagreeable. The famous swimmer, Capt. Webb, who crossed the Channel to France, apparently cared less for the distance than the acalephæ he expected to meet on the passage over.

The beautiful velellæ (chiefly inhabitants of the Tropics), are often conveyed by the Gulf Stream and cast on the Irish coast. It presents an oblong, flattened, transparent body (rounded at the

angles) from which depend numerous deep blue tentacles. From the upper surface, which is covered with dark blue spots, is a thin plate rising vertically along the back, used as a sail, so say the oldest naturalists. But I think I have read something like this about the nautilus :—

"Spreading their sail-like arms to catch the breeze."

The idea may be poetical, but it is very erroneous.

The *Physaliæ.*—Of a higher order as regards size, pre-eminent in beauty, and surpassing all other medusæ of the Tropics, is the physalia caravella, or Portuguese man-of-war, so called by the ancient mariners from a supposed resemblance to the caravels of this once great maritime kingdom. The transparent body about a foot in length and four inches wide displays every shade from purple to violet, while the comb-like sail at the upper extremity is brilliant crimson, the tentacles hanging from the lower portion of the body itself trail behind in rear. They are also coloured, the shades slightly differing from the body tints. It can extend the arms to a distance of twenty feet; they can contract themselves so as almost to disappear altogether; they possess the means of paralyzing the prey they embrace.

On my passage to Jamaica in a troop ship, I induced the cook to rig up for me a rough sort of landing net out of some spare ones he boiled the vegetables in for the midshipmen's mess. I felt quite pleased at the great interest the young gentlemen themselves took in the proceeding, more especially when one of them volunteered to take up a position in the bow (from whence the sailors harpoon the dolphins) to angle for me. "I have him this time," cried the young reefer (or rascal), and as he lifted the net I eagerly pressed forward to the front, and fearing my beauty might succeed in slipping back into its native element, I seized it firmly. Had I grasped a red hot iron bar I could not have dropped it more suddenly. Whether the shock proceeded from the body itself or the tentacles I am unable to say, but I never felt anything so painful. Indeed, nothing can be more truthful than the remarks of Dutertre, in his history of the Antilles, where he alludes to the corrosive qualities of this extraordinary creature :—"Even man, when he comes in contact with its tentacles, needlessly or through ignorance, suffers excruciating pain. One day when sailing in a small boat I saw a physalia, and being anxious to examine it more closely, I tried to get hold of it.

Scarcely had I stretched out my hand when it was enveloped in a net of tentacles. After the first impression of cold (it had a cold touch), it seemed as if my arm to the shoulder had been plunged into boiling oil, and I screamed with pain." I dare say I would have done the same had no one been present. I fear I used some very unparliamentary language instead.

The bituminous matter in the chert beds, more especially near the base is difficult to explain away in a satisfactory manner. While it seems probable it was derived from animal or vegetable remains, I think it improbable that the sponges ever have contributed anything to the substance, for they are confined to the upper or glaciated beds. It is evident also that the graptolites, (rarely found so low down), can scarcely be the source. Impressions of plants occur, but they are not so numerous or so well preserved as in the limestone beneath where no bituminous matter is found. It has been suggested that jelly fishes (medusæ) which would leave no markings to record their existence, may have been the source. It appears to be probable.

BRIEF NOTES ON MARINE ANNELIDS, ERRANTIA AND TUBICOLA.

Read before the Geological Section, Dec. 26th, 1890.

BY COL. C. C. GRANT.

Since the discovery of the "conodonts" (fossil teeth) by Prof. Pander in the lower silurian rocks of Europe (pronounced by Owen to be the spines or denticles of mollusks or annelids), considerable attention has been directed to this minute class of organic remains. Perhaps the largest and finest collection was obtained by Professor George J. Hind, from the Clinton palæozoic beds at Dundas. In this neighborhood at a similar horizon the paired burrow of a lob-worm and the trails of other annelids are often seen. It is no easy matter to distinguish a crushed or flattened fucoid from the trail of a worm in a muddy sediment, when the former was cord-like in structure. But I think I am in possession of satisfactory proof that many of the so-called trails are really algæ. It is singular that with a solitary exception no teeth have been found as yet here. True, they are so minute they may easily escape observation, but then they have a horny or chitonous lustre which the practised eye must quickly observe.

Like the common earth worm or leech the marine annelid is capable of considerable extension or contraction, the rings or segments of the body are joined together by an elastic skin. They have red blood. Many are provided with eyes, and some species (the errantia) have powerful jaws armed with incisive teeth. From the soft nature of the body the latter alone are likely to be found preserved in a fossilized state. I have frequently seen them darting off apparently with the wriggling motion of the eel, not crawling along the bottom; indeed they seemed to be some inches above it. Water in rippling over a shallow shore is rather deceptive, however. A well-known European annelid, Eunice sauginea, attains a length of from two to two and a-half feet. According to the naturalist, De Quatrefages, it possesses no less than 300 body rings, a brain, 3,000 nerve branches, 280 stomachs and twice as many hearts. While Nature

has been so exceedingly lavish regarding the internal structure, she has been far more so in respect to external appearance, for nothing can be more brilliant or beautiful than the colouring of many of the species of the despised class known as the vermes. One naturalist finds the tints most exquisite, surpassing even the flowers of the Tropics. Another states they combine the hues of the humming bird with the metallic lustre of the South American beetles, while a third emphatically protests against the ignorance which prevails respecting his pre-eminently beautiful Nereis, Euphrosyne, Eunice, Alcyopa, names selected from Grecian Mythology, expressive of the most intense admiration of the little-known, neglected, but truly beautiful creatures.

The *Tubicolæ*, or solitary annelids, possess the means of secreting mineral matter, carbonate of lime, from the water, to form the tube or shelly covering for their protection. This tube was sufficiently hard to permit of fossilization. Our modern Serpula is a familiar example. You may notice it frequently attached to oysters and other shells; this worm is furnished with a beautiful crown of feathery tentaculæ, doubtlessly for the purpose of attracting and seizing its passing prey. It is said they are used for the purpose of creating a current and drawing microscopical organisms within its influence. Nature may have had another object also in view when she embellished the feathery crown with such brilliant colouring and varied tints as it possesses.

I am enabled to submit for your inspection a well preserved specimen of a cornulites, a member of the family from the glaciated Niagara chert of Hamilton. Although the tubicolæ are solitary, strictly speaking, entire colonies are often found attached to shells in our day, and in precisely the same way we find them grouped on the valves of the Cambro-silurian brachiopods. In many instances the worms appear to display a tendency to form irregular circles, as if they wished to make the most of the limited space at their disposal. Dr. James Hall, the Director-General of the New York State Geological Survey, contends that the coiled spirorbis and the ortonia of the late Professor Nicholson merely represent a cornulites in the earlier stages of its growth. The slabs figured in illustration strongly corroborate his views.

Nemertes Gigas.—Perhaps the most extraordinary of the vagrant annelids is the great *Nemertes.* There are two species, one violet col-

ored and the other brown. Both seem very rare; the late Professor Adams, of the Queen's College, Cork, informed me he was unable to recall anything answering to the description of the specimens I had seen on the southern coast of Ireland. I subsequently discovered my animated ribbon, with a pointed snout, described by the German naturalist, Dr. Hartwig. His description was so much superior to mine that I trust you may feel disposed to pardon the extract for its accuracy.

"This giant worm forms a thousand seemingly inextricable knots, which he is continually unravelling and untying. When he desires to shift his quarters, he stretches out a long ribbon surmounted with a snake-like head. The eye of the observer sees no contraction of the muscles, no apparent cause or instrument of locomotion. The microscope, however, reveals vibratory ciliæ covering the body. He hesitates, he tries here, and there, until at last, often at a distance of 15 or 20 feet, he finds a stone to his taste, whereupon he slowly unrolls his length, and while the folds are unravelling themselves at one end, they form a new Gordian knot at the other. It is from 30 to 40 feet long."

In "The Cruise of the Blake," the younger Agassiz gives a representation of a vagrant annelid, sagitta, dredged in the Atlantic. It presents a ventral fin and the rounded tail of a fish. Many of us, (judging from its outward appearance), would feel disposed to place it above the hag-fish or lamprey, but I presume the nervous axis has been detected and the classification is quite correct. It certainly leads one to think of connecting links and such things. The description afforded us is not so full or satisfactory, perhaps, as some of the other chapters, but the work itself, taken altogether, is to this continent of greater interest and importance than any record ever published hitherto. It is the noblest contribution that the United States ever gave to science. No work possesses greater fascinations for the naturalist. We may all learn something from it. Can this be said of many of the novels we find so often in the hands of the younger generation?

The marine annelids of Anticosti (at least the few I saw) struck me as devoid of the brilliant colors noted elsewhere, but they are singularly active. They have need to be so, for their principal foes there, the eels especially, are exceedingly numerous. At night I have seen them by dozens on the margin of the shore feeding on the

heads of cod-fish flung aside by the fishermen, and the mouths of rivers and streams are paved with them on their way to the spawning ground.

A very singular fossil puts in an appearance in the lower green and red Clinton shales here. Although I discovered it a quarter of a century ago, I believe it remains as yet undescribed. I submitted it for examination to several Palæontologists, both on this continent and Europe. The general opinion seems to be, that it represents *the track* of something as yet unknown. One gentleman in the old country states, "it reminds me of such an impression as a beetle may make pursuing its way over a muddy shore." Now we have no evidence that such a thing existed until the Jurassic Age, that is, as far as I know. Contrary to the almost unanimous opinion, the late Mr. Billings supposed it to be *organic*, and he mentioned he had seen something not unlike it in still older rocks (Cambro-silurians). I noticed it usually occurs entangled as it were, among the branches of sea plants. I have always held the same view as the one entertained by the late Palæontologist of the Canadian Geological Survey, as regards its organic nature. I considered it may have been a species of nemertes possessing a body which admitted of partial fossilization at least. This necessitates, however, an explanation of the absence or disappearance of the outer skin. It also requires the production of any instance where the more durable parts of an annelid is shewn to be internal not external—that I admit is a difficulty. We are merely groping in darkness now, "children seeking for light," as the Rede lecturer at Oxford recently said. We know not how soon the veil may be drawn aside that conceals many a secret of Nature yet involved in obscurity.

Sir W. Dawson kindly furnished me with a paper recently published in "The Quarterly Journal of the Geological Society," entitled "Burrows and Tracks of Invertebrate Animals in Palæozoic Rocks and other Markings." In this Sir William refers to the impressions from the Clinton beds of Hamilton. In a few cases you may remark I appear to hold a different view. Well, while the distinguished veteran Palæontologist states that there is confessedly some difficulty in separating the marks known as "phymatoderma" from fucoids, and even the stems of coniferous plants. I may claim pardon if I have expressed an erroneous opinion in some instances. I do not for a moment doubt that marine worms, as stated by Sir

William, must have culminated in regard to size, abundance and range of organization at a very early geological period. In fact we have very conclusive evidence of that in the neighborhood of this city—Hamilton. At the same time I believe that many of the supposed annelid trails, casts or burrows may yet be classified as marine plants or true fucoids. I have much pleasure in submitting for the examination of the Section photographs of specimens of Clinton slabs from Hamilton, as given in Sir Wm. Dawson's paper. His suggestion that the worm-like stem of a lingula may have formed such burrows as we see occasionally seems so probable that I fancy many must concur in that.

IRISH CELTS AND THEIR RELICS.

Read before the Geological Section, Feb.-May, 1891.

BY COL. C. C. GRANT.

Within the past century much additional light has been thrown on the subject of Pre-historic and Pagan Ireland, by Dr. O'Donovan, Eugene Curry, Professors Graves and Todd, Trinity College, Dublin. The Ossianic Society, by giving us translations of the lays and traditions of the Gael have contributed also not a little valuable information respecting our Celtic forefathers. However, on the whole it may be admitted that the knowledge we possess of our early history is very little indeed. The Monkish chroniclers evidently entertained but slight affection for the bards, an order likely to keep alive the memory of things they were desirous of consigning to oblivion. Probably this may account in some degree for the very meagre details of pre-Christian times incorporated in our oldest manuscripts.

The Royal Antiquarian Society, of Ireland, (embracing Irishmen of all creeds), is one of the noblest conceptions that ever emanated from the distinguished sons of our Irish soil. Independent of the knowledge we are likely to acquire from this union, we may also realize the dream of the poet and patriot, whose mortal frame reposes in Irish soil, the land of his birth.

"And O! it were a glorious deed
To show before mankind,
How every class and every creed
May be in love combined;
May be combined yet not forget
The fountain whence it rose,
As filled by many a rivulet
The stately Shannon flows."

I.

As in all records of ancient races, doubtless there is much that is fabulous in the early history of Ireland. Who were the primitive inhabitants—from whence did they come? This problem may

never be satisfactorily solved. All who accept the theory of the Aryan migration must admit that many of the so-called Celtic myths may yet prove to be based on actual facts. Ireland abounds in limestone caverns which probably are rich in organic remains and implements, such as were found in England, Belgium and France, but as far as I know no proper examination under duly qualified geologists has been made, save in one instance, when the late Professor Leith Adams opened a few ossiferous caves in the County of Cork. This state of things does not seem exactly creditable to Irish geologists. The Anthropological Society of Great Britain has an unexplored field there for further research, and surely it would be of unquestionable importance to science if our neglected caverns or grottos were forced to reveal the hidden secrets they perhaps retain. Continental explorers have unquestionably proved that a race of men like the modern Esquimaux in interglacial times, if not earlier, left their skulls and bones there mixed with the remains of animals still existing in the Arctic Regions, elsewhere extinct. Within the past half century in a cranogue at Lough Gur, in the County of Limerick, the bones of the Arctic bear were unearthed. Does such a find indicate a more southerly range as its habitation? Further exploration can alone throw light on the subject.

It is probable that Inis-Ealge (the noble island), received at an early period, pre-historic of course, a few colonists from Great Britain in their hide-covered corroghs. The bardic annals, alluded to by more recent writers, mention a people named Fomorians, or sea robbers, who visited the island on plundering expeditions previous to the arrival of the Fir-bolg colonists, so called from the leather bags they carried. Tighernagh, Abbot of Clonmacnoise, who lived in the eleventh century, considered all records regarding historical tradition beyond B. C. 305 as doubtful chronicles. Many of the statements would appear to him incredible which no man to-day would doubt who has studied the topography of the island, or who has been impressed with a view of such extraordinary monuments as were raised by the pastoral Fir-bolg or highly civilized Danaan, the skilled mechanic. The burial places of the kings of the latter people, Dowth, New Grange, etc., Dr. Petrie states "rank after the Pyramids of Egypt," yet all we know respecting them is this, "a thousand years ago they were broken into and plundered by Ostmen (Danes)."

Military Architecture—Pagan Ireland.—Among the most ancient stone forts in existence are Dun Ængus and others in the Island of Aran, and what is known now as Staignes in the County of Kerry. The former is the more extensive, the latter in extraordinary preservation for a ruin that Wilde mentions as having existed for at least 2,000 years. I have not seen either, but an excellent model of the Kerry fortress, composed of stones used in its construction, enables one to form a clear idea of the structure. The original is nearly circular, 114 feet in diameter, 13 feet thick at the base, and a little more than 5 feet under the coping stone; there are two chambers in the massive wall. A series of steps inside the latter led to platforms for the defenders. It was built without mortar or cement, in what is known as the Cyclopean style of architecture. I am not at all surprised that the Dublin *Antiquarian* remarks:—"One is led from similarity in structure to the earliest Pelasgian monuments of Greece to suppose an identity of people." The stone fortresses like these are said to be the work of an early colony called Fir-bolgs, Belgian Celts perhaps. The bardic chronicles, our early annals, inform us they came from Greece originally, that they were of Sythian descent. Is it not strange that the new Aryan discovery of Max Müller was known in Ireland more than a thousand years ago? The jests of a few English critics on the subject seem rather out of place.

Stone Habitations—Clochauns of Fir-bolgs are found chiefly in the islands off the west coast of Ireland. Some are circular, dome-shaped buildings, formed by the flags overlapping, (the principle of the arch being apparently unknown), large enough to house several families. Dr. Petrie supposes a few, at least in Aran, were erected as monasteries and religious establishments in the sixth century. If his opinion is correct they must have taken the monuments of the primitive inhabitants as their models While admitting there is still strong evidence that monastic communities were established in the western islands long before the Norman invasion, I confess I am disposed to think the early Christians may have, possibly from this ancient, pastoral people, known to us as Fir-bolgs, Dumnonians, etc., acquired the cells and Pelasgian remains subsequently converted to the purposes of Christianity when this religion was substituted for Paganism.

Sir Wm. Wilde states, the Celtic city of Fahan, near Ventry

Harbour, abounds in cahirs and clochauns. From the description given of it, it appears to be of very great antiquity. In a note to a chapter of the History of Ancient Ireland, by Mr. Haverty, the writer expresses his belief that we have the descendants of these Belgian colonists yet among us. The brachycephalus (round skull) may be frequently noticed in Connaught and among Kerrymen in confirmation of this opinion.

Mortuary Urns and Cremation, Pagan Ireland.—The mortuary urns of the pre-historic inhabitants of Ireland are very beautiful, both in design and execution generally, but I have seen some few exceptions which one may compare with the rude pottery of the Indian ossuaries in Canada. They are found both in tumuli, i. e., Druids' altars or cromlechs, and in what we call kists and caverns, rarely however in the latter. In most cases they contain ashes and burnt bones. The kist itself is a small bee-hive like structure, (sometimes square) a little beneath the surface of the soil, and probably was formed where the body was cremated. In addition to human bones, remains (teeth) of the dog have been found also in the urns, which leads us to conclude the hound was cremated with the master. The cromlechs may have been the sepulchral monuments of the more distinguished chiefs. The memorable discovery of the one in the Phœnix Park, Dublin, A. D. 1838, first opened the eyes of antiquarians to the real nature of the so-called altars and sacrificial stones, when the pick and spade of the working man solved a problem which all the learning of Europe failed to decipher. In levelling a mound about fourteen or fifteen feet high the labourers came on a massive flagstone resting on others placed perpendicularly. They had previously discovered a little outside this, i. e , the central point, four small kists containing burned bones ; inside the chamber formed by the flags were two complete male skeletons placed not full length (the space did not admit of that), but bent as it were at the knees ; a number of small littoral shells, pierced for a chaplet or neck-lace apparently, lay close to each skull ; a bone pin, two arrow points and a flint knife were lying near by also. The circumstance of finding the two modes of burial in the same mound Sir Wm. Wilde notes as "a remarkable fact." Warren Moorhead, I think, mentions that the Red Men of Ohio at a recent period frequently interred their dead in the pre-historic burial places of the mound-builders.

It is stated that many of the jet and amber beads in the Royal Irish Academy, Dublin, were obtained from tumuli like the one in Phœnix Park. I can find no confirmation of this, and am inclined to think the amber, at least, was obtained either in war at a subsequent time, or by barter with the Northmen. The shores of the Baltic have been long famous for the production of the mineralized gum, amber. This is the only place from whence it was obtainable, I believe, in the North-west of Europe.

This ancient people have left us their stone axes (celts), flint arrow-points and spear heads, perhaps, I may add, the copper celts likewise in our National Collection in Dublin, Ireland. The celts alone are about 500. If we compare the flint and stone weapons and tools of this ancient tribe or people with a like collection manufactured by Mound-builders or Indians, we may immediately perceive the marked superiority of the former as regards design. They had attained a more advanced stage of civilization, perhaps, than the mere hunting Red Man of this Continent. It is singular that as yet we have obtained no stone gouges such as you may remark in almost every collection one sees here. The gouges of this material now in our Irish Museum were presented to the Irish Academy by the King of Denmark. The bronze ones in our National Collection were moulded by artificers, I think, who had taken the more ancient stone ones as their models. Some of the latter may have turned up since I left Dublin thirty years ago. In one of the mortuary urns a flattened piece of copper was found with calcined bones. This leads one to believe our Irish Celts were acquainted with at least one of the metals at a very early period.

The bone weapons—daggers or skeans and other implements—in all amounting to between forty and fifty, I think, in Dublin in 1861, are older than the time of the mechanical Danann or warlike Gædhil. This may be an erroneous opinion on my part. In a paper contained in the Proceedings of the Anthropological Society of Great Britain some years since, the writer stated:—"The stone and flint implements are almost alike in Denmark, France, Ireland, New Zealand and Mexico, and the pottery of this (the stone age), is akin also with similar ornamentation, while the tools and weapons of the bronze age in Italy, Switzerland, Ireland and Denmark bear a near resemblance." In a general sort of way the assertion holds good probably, but an expert antiquarian in many cases could point to some

peculiarity in manufacture which enables him to detect differences which men who have not made the matter a study cannot perceive. For my own part I was unable to recognize a collection of stone and flint implements from the Highlands and Lowlands of Scotland when mixed with a like assortment from such as are seen in our Irish Academy, Dublin.

Where a marked superiority may be noted in a few instances, it may be owing to individual skill as well as to the spare time a pastoral family tribe may have at their disposal for manufacture. No doubt the number of celts in the Irish Academy (500 nearly thirty years ago when I was in Dublin), may have been considerably increased since then.

In the papers published by the Belfast Naturalists' Field Club, some years ago, it was stated that many of the beautiful bronze spears and swords now in the Belfast Museum were found in that district in tumuli. The latter are of two kinds, one long and tapering (rapier like), the other short and wide (leaf shape). If the statement is quite accurate it goes far to prove that the people of the bronze age buried their dead in the same manner as the race which used stone and flint instruments.

It certainly is difficult to understand how men unacquainted with the use of metals (as the earlier colonists), could have raised up and placed in position the enormous masses of rocks which form the covering flags of several of the Ulster cromlechs. One of the blocks (Cloughmore), is granite. It is 13 feet long, 10 wide, and 5 in thickness. Its estimated weight is 50 tons; several others weigh but little less. It appears to me equally difficult to offer any satisfactory explanation regarding the Irish mound-builders. The tumuli of Ulster seem more numerous than in Connaught, where the descendants of the Fir-bolg Celts are supposed by many Irish antiquarians to be still represented. I differ altogether from the writers who suppose the differently shaped bronze swords may be attributed respectively to the Belgian and Danann tribes. Both I think characteristic of the latter. The kistvans of Ulster are tumuli on a larger scale, containing several chambers. I cannot say whether they are confined to the province. I have not seen them in any others; that is purely negative evidence and does not show their non-existence. An Irish guide was asked the meaning of this term by an English tourist. "Sure, man alive," was the reply, "'tis the

place you live in when you're dead." In the Irish bull he unconsciously repeated the belief entertained by our Celtic or Aryan forefathers, viz., that the soul or spirit frequents the place where the mouldering clay is deposited. Stone circles similar to the one at Stonehenge in England, and Brittany, are not uncommon. What they were used for still remains an unsolved problem. The same may be said of the pillar stones, although in some cases there is reason to suppose some of the latter were erected to mark the spot where a favorite chieftain or champion had fallen in battle.

II.

There was one kind of burial omitted in my last notes respecting Pagan Ireland, perhaps because it seems to have been an unusual one, viz. :—when the king or chieftain was interred in a standing position, as an ancient poem states, "with the red javelin in his hand and his face to his foes." Two skeletons at least were discovered in this upright position, in one instance the covering flag rested on the skull apparently. No weapon or ornament was found, so I think we may infer the spear-heads were iron, which could not be very well preserved under such circumstances, that is if the arms were actually placed beside the dead warriors, as stated by the bard. A great many, if not the majority, of the bronze spears and celts in Ireland were obtained from fords, in deepening the beds of rivers, and in bogs. Owing to the green crust which has formed on them they frequently present the appearance of malachite. In fact, one is led to believe the immersion they had undergone materially contributed to their extraordinary state of preservation. Many of the iron spear-heads and javelins also were discovered in like situations, but I cannot say if any deposit of carbonate of lime was noticed as encrusting them. I am disposed to think they must have suffered more from oxidation unless they were so protected.

At Kildrinagh Ford, on the River Nore, Queen's County, a very interesting discovery was made by the Board of Works some years ago. On removing about a foot and a-half of the loose gravel and sand, the workmen came on the remains of a bridge of black bog oak, and embedded in the harder layer beneath were three skulls; near the human remains were four bronze swords, two iron ones and two iron spear-heads. As far as I can recollect one skull had a skean or dagger sticking in it. However, I may confound

this with another "find" in or near Borris in Ossory. There is no reason to suppose that the weapons were deposited at different periods, they were all lying at the same level, the iron ones not lying above the bronze. The same circumstance was remarked when deepening the fords of the Shannon, but at Meelick and Keelogue the stone celts were invariably below the others, according to intelligent supervisors of the workmen. The matter is doubted by others.

Weapons of the Irish Celts.—We have no means of ascertaining when the Pagan Irish became acquainted with the use of metals. It appears likely enough that the primitive Fir-bolgs had acquired a knowledge of melting and moulding copper. The rude axes and tools of this material were evidently modelled on the stone ones of the earlier times. The succeeding colonists, if we may credit the bards and annalists, were the artificers of the magnificent collection of bronze swords, spears and war axes now in Dublin, London and other places Two great battles were fought at North and South Moytura, ending in the defeat of the Belgians or bagmen. "The memorials on the fields" Wilde remarks, "to this day attest the truth of the statements recorded by historians." To the superiority of the weapons and magic, i. e., skill of their more highly civilized foes these Fir-bolgs attributed their defeat. It is said they were driven to the Western islands and other inaccessible places, but returned and became gradually absorbed in the general population. Eugene Curry was in possession of an ancient manuscript giving quite a different version of the second fight at Moytura. He arrived at the conclusion that the result was not a complete victory. It ended in a compromise by which they remained in undisturbed occupation of Connaught. This, if true, would go far to explain the marked difference in physical appearance between the peasantry of the West and other parts of Ireland.

Copper Spear-heads.—Only a few have been found. It is not improbable that some of the weapons of this material were re-cast subsequently, as has been suggested, when it was ascertained that tin possessed the property of improving it for military purposes.

Bronze Spear-points, etc.—Although our National Collection is the largest in Europe, viz., 276, it by no means represents the actual number discovered within the past century. The British Museum also secured many of our specimens. When I was quartered at Birr, now Parsonstown, I saw in possession of a local antiquary

there, an exceedingly fine collection of Celtic relics. It was particularly rich in bronze spear and javelin heads. I understand Mr. Day, of Cork, has also a remarkable one. In fact the private collections are very numerous. Bronze arrow points are rare comparatively speaking. The Irish and Welsh Kern, the true bowmen of Crecy, used steel or iron points. This material does not admit of being well preserved for any great length of time unless in very exceptional instances. I may notice here a singular fact relative to King Edward's wars in France. One of the Irish leaders, an Earl Kildare, was created a knight for valor on the battlefield; another, the Prior of Kilmainhan (Butler), was made an earl for services rendered on our foe. Numerous as are the bronze swords and skeans in the Royal Irish Academy (280 odd), I do not think we possess a single specimen of the former retaining the handle of the blade. "Solinus mentions," remarks Wilde, "that the Irish formed the hilts of their weapons from the teeth of large sea monsters, which they polished to a beautiful whiteness." If the walrus furnished the material it seems difficult to understand why such a substance as that was not preserved. Gold-hilted swords are frequently mentioned by our annalists. On one of the blades found in a bog in Limerick County, a portion of the gold mounting was attached to the handle; on another, from Tipperary, was a fragment of the precious metal weighing twelve pennyweights and nine grains. In 1751 a sword was found with a plate of gold, rivets fastening it on one side, weighing between three and four ounces; another was discovered two years after similarly ornamented. It is not improbable that in some instances many of the weapons were flung aside when they had been stripped of the gold plates forming the handles. No complete scabbard has yet been found, but I think I noticed the bronze tip of one which possibly was fixed on a leather sheath. It is not likely that such would have been preserved unless in very exceptional instances.

Dr. Crawford, a distinguished member of the Anthropological Institute and Fellow of the Royal Society of Great Britain, endeavors to show the bronze weapons of North-West Europe were of foreign introduction, in the course of barter. From the small hilts of the swords, Danish probably, he supposes they were the work of an Asiatic people.

A considerable number of our Irish antiquarians think they may

have been derived originally from the Phœnicians, the earliest navigators and merchants, who founded Carthage, and sent colonies to Sardinia, Sicily and Spain, a thousand years B. C. They traded to the Cornish coast for tin, one of the constituents of bronze.

Several of the Irish weapons have been analyzed, and are found to contain from one to fourteen per cent. of tin, and in some instances a small percentage of lead also.

Although the Sidonian origin is not generally accepted, I confess I cannot see the improbability of it. The early Celtic Danann tribe, in Ireland, have left us several of the moulds for casting spear heads and battle axes. The circumstance does not prove that the manufacture of the metal implements had, as has been stated, gradually been developed, and not originally acquired from a foreign source. Pouchet's theory is that the small-helved swords (Scandinavian) were used by the women of North Europe, who usually fought among the men.

Bronze Celts, Axes.—Ireland is known to antiquarians as "the land of the bronze celt." No country known to us can display such a collection as she possesses. In the Dublin museum cases alone, there are 686; and altogether 1,500 more are known to be in possession of private collectors, etc., independent of a large collection purchased or obtained by the British Museum. You may find them likewise scattered all over the United States, great numbers having been purchased from dealers by American tourists. Many of the Scandinavian celts are decorated in the same way and fashioned in the Irish manner, but when the suggestion was made that the Ostmen may have acquired them during the centuries of incessant warfare they waged against civilization, the singular fact was mentioned by a Celtic scholar, that although copper (umha) and tin (stan), white and red bronze, (ban and derg umha), are mentioned by the earliest annalists, they seem to be ignorant of any implement whatever bearing a resemblance to a bronze celt. He considered this a positive proof of very great antiquity.

It may be remarked, comparatively little of the monkish records have been preserved. What escaped the Danes fell, in after times, into the hands of men equally ignorant.

More than a century ago Dr. Hamilton, F. T. C. D., exhibited to the Antiquarian Society a bronze celt in its stone mould; several

castings of a like material as well as of clay, sand and mixed metal have been more recently obtained.

The palstave, or winged celt of Scandinavian antiquaries, is frequently found in Ireland, as also the rude plain one and the socketed variety.

A bronze celt now in Berlin, Germany, was discovered in a tomb in Etruria. I have not seen a representation of it.

The sculptured stones of the great pyramid and catacombs of New Grange, County Meath, already referred to as the burial place of the Danann kings, bear a marked resemblance to the incised ornaments of some celts. While their use is as yet considered a matter of uncertainty and conjecture, I hold the circumstance of finding them so frequently in river fords is strong proof of their use as battle axes.

I think only three bronze mace heads have been discovered. I may be mistaken, but I am under the impression that it has been stated this was a weapon peculiar to the Franks, and another writer is of opinion it was borrowed from the Saracens in the time of the Crusades. Anyway, mention is made of a church dignitary, who was averse to shedding blood with such a carnal weapon as the sword. After a desperate resistance he was made prisoner on the battlefield, and confined in the tower. The Sovereign Pontiff demanded his immediate release, as one of the church's children. The Plantagenet king in reply forwarded to Rome the battered coat of mail his captors had found under the prelate's ecclesiastical habit, with the query, "Is this your son's coat or no? Does your Holiness recognize in this implement (the mace), with which he brained two of our trusty knights, any resemblance to a bishop's pastoral staff?" History does not inform us regarding the result. We may hope the warlike prelate ultimately obtained his liberty, and that his Majesty was satisfied with the joke at the church's expense. The steel spike mace, so common in the middle ages, is alluded to by Scott in the encounter between Richard Cœur de Lion and the Saracen, Emir Saladin. I understand it is represented also in battle scenes from the Assyrian palaces.

Pillar and Ogham Stones.—These have been for many years the cause of some little discussion and controversy among Irish antiquarians. Although bracketed as above, perhaps it were better to separate them into plain or pierced and inscribed pillars. One

party contends the former were used as boundary stones in the same way as the milestones we find on our ordinary roads still. The other asserts that the early annalists in many instances allude to them as marking the burial place of a champion. It seems to me the translation of two distinct manuscripts by Dr. Petrie, in his work on the round towers, ought to be deemed sufficiently conclusive on the point. See the following extracts:—

"The pillar stone of Buide, the son of Muiredh, where his head lies."

And in describing the death of Fothadh, slain at Ollarba, fought A. D. 285, "There is a pillar stone at his cairn and an ogham is on the end which is in the earth."

A mortuary urn, containing bones and ashes, was found at the foot of a block of stone erect, in the County Antrim, not many years ago. With respect to the pierced pillars we know it was an eastern custom to set up memorial stones by various ancient races.

Danish Raths.—Scattered all over Ireland, met with everywhere, are the circular earthen entrenchments, ignorantly attributed to the "Ostmen," and known as Danish raths. They are usually surrounded by a deep fosse, or trench, partly filled in sometimes. Doubtless they were further strengthened by a palisade, for I recollect finding in one of the ditches a pointed stake; it owed its preservation to the boggy soil in which it was imbedded.

Old men who had a vivid recollection of the insurrection of '98, informed me "the raths" were formerly more numerous, and that numbers had been levelled by the gentlemen and farmers about.

Many of them evidently are of great antiquity, "Rathcroghan," for instance, where the Connaught kings were inaugurated. The houses, huts or dwelling places were formed of timber or wicker-work plastered with clay, and covered with reeds or rushes—of course, such perishable material would quickly disappear. Some of the churches were built of timber, "more Scottorum," according to Bede.

When we reflect that wolves were very numerous until comparitively recent times in Ireland, that we were not always so much given to peaceful pursuits, as in our own day, that there may be even a slight foundation for accusing us of "cattle-lifting" occasionally, you may see the absolute necessity of our forefathers taking the precaution of erecting such places of refuge.

I opened a rath not far from Carrig-Cleena, in the County Cork,

a cave where Cleena, the Queen of the Fairies, is supposed to hold her Court. On removing the sods and surface soil from a central point the spade came in contact with a large flag resting on others in an upright position. On removing the upper slab I discovered an underground passage, running apparently in the direction of the nearest rath. Owing to foul air I was unable to penetrate more than a few yards, but I came to a small chamber, built of stone, without mortar or cement, bee-hive shaped like the kists. Probably all the raths around were connected in this manner for defensive purposes.

A gentleman in Mayo, some miles from Castlebar, pointed out to me a similar chamber in a rath there. He suggested it may have been used for storing wheat, etc; I thought so too. The chamber had also a spring well. The site was in a military point of view admirably selected in every way. I am inclined to believe some of the raths were occupied more recently than is suspected. I obtained, on more than one occasion, tobacco pipes differing but slightly from clay ones now used; a hand quern for crushing wheat, etc., is precisely like the ones you may remark in the cabins of the Connaught peasantry yet. I have seen coins of James II., which were said to be obtained from the trench of a rath.

In the Rhind lecture for 1889 Professor Munro concluded as follows:—"The earliest lake dwellers of the stone age knew the arts of spinning and weaving, cultivated the cereals, had domestic cattle, paid attention to ornament, and in fact were in possession of all the elements of civilization." After a period of transition the stone passed into the bronze, characterized by higher refinement and knowledge. He thinks the latter was brought about by the advent of a new race of settlers. From the sudden appearance of the iron age and the perfection which iron itself appears to have attained at once, he showed it indicated a new race of people who had conquered the old lake dwellers. His conclusion was that they were a branch of the original Celts, i. e., the ancient Aryan stock.

The extract above differs little from what he stated in his work "Scottish Lake Dwellings." Neither does it in a general way from my conclusion regarding the early inhabitants of Ireland.

In one of the Irish cranogues, Dunshauglin, Meath, among a vast number of antiquities, human remains, etc., several slate and bone disks were discovered, precisely like the ones from the Canary Islands, Teneriffe. The cranium of a Guanche mummy coincides

in several respects with the heads in our tumuli. The disks, as Wilde suggests, were used probably for spinning thread.

III.

I may be reminded that the Irish Annals refer to the landing of a chief, called Partholan, and his sons, before the men of the stone age, Fir-bolgs. We may, I think, dismiss it as questionable if not altogether untrustworthy.

Indeed some modern writers are disposed to question the existence of the Danann Tribe altogether; they consider they were merely the succeeding generations of the Celtic Cimmerians or Kimri, which, under more favorable conditions than they had previously enjoyed, gradually acquired an independent civilization unindebted to outside influences. If this could be established it would be a singular fact in the history of mankind. Such development may not be impossible, it certainly was unusual. I hope I have not misunderstood the purport of this criticism, which appeared in an English paper after the catalogue of Irish antiquities was published. The actual words I cannot recall. It was not an unfair one on the whole, but the writer I think failed to see that he possessed only a very superficial knowledge of the subject. I do not intend to imply by this that the critic was unacquainted with Celtic English antiquities, but he appeared to me to know very little respecting our Irish ones, and more especially their surroundings. The bardic traditions relative to the Milesian invasion, which was said to have taken place 1700 years B. C, was rejected also on the grounds of its utter improbability.

I do not suppose a people using stone implements only, could have fashioned such vessels or canoes, as may have enabled them to reach the Irish shores in the way related. The succeeding wave of immigration possibly introduced the Dananns, a tribe highly civilized. If they were not actually Phœnicians, as many of us think, from whence did they acquire the knowledge they unquestionably possessed? The glass beads and ornaments of blended colors found in their mortuary urns, burial mounds and catacombs, can scarcely be excelled in the present age. That the Sidonians were acquainted with navigation admits of no denial, and we learn from the father of history and others, that at a very early age indeed, their ships sailed round Africa. In Wilde's narrative, "Travels in Egypt, Pal-

estine, Tyre, &c.," referring to the last you may find this extract: "As an Irishman I felt no small degree of interest on first touching the motherland, whose colony we claim to be. I asked myself, was this the city whose antiquity was of ancient days, the mart of nations? Could this be the strong city Tyre, the daughter of Sidon, whose ships were constructed of the fir trees of Senir, the cedars of Lebanon, the oaks of Bashan, which pushed her colonies beyond the Pillars of Hercules to Gades and the Isles of the West?"

Again, the same writer remarks, when describing some of the peculiarities of the tombs he discovered at Tyre, (Palætyrus), "I mentioned the similarity that existed between the ground plan of the Egyptian, Phœnician, Grecian, and also the Irish, as exhibited in cromlech or pyramid of New Grange, in all of which the tomb consists of a stone chamber having three recesses or tabernacles for bodies, i. e., one on each side and one opposite the entrance. Now, in these chambers that I have just described the same character is preserved, showing a similarity of sepulchral architecture throughout these several countries." Herodotus, who lived 413 B. C., states, he "was informed by the priests of Hercules that their temple was in existence since the city was built 2,300 years before." The celebrated Sir Isaac Newton in his "Chronology of Ancient Kingdoms," mentions the Phœnicians going to the coast of Spain, building Carteia, Gades, and Tartessus; others going further to the Fortunate Isles, to Britain and Thule. History tells us, the Persian fleet, sixty in number, were defeated by twelve Sidonian ships. They must have been superior both in size and skill to overcome such a disparity of forces. The suastika, or symbol of fire, which Schliemann claims to have discovered recently, in what he considers the ruins of Troy, is also engraved on sculptured objects from Africa, India, Greece, Denmark and Ireland.

When I was quartered in the Ionian Isles I was presented by a Greek Monk with an oval lead bullet about the size of a bantam's egg. It was found in a tomb in Cephalonia, and was supposed to have been used by a slinger in Pagan times. There is in Dublin a mould which was formed apparently for casting such missiles.

In a paper by John I. Robinson, A. R. H. A., on "Celtic remains in England," referring to photographs taken by Mr. Allen, I find this statement:—"I think that the light now being thrown on the subject goes to prove the truth of the Irish annals and traditions.

It is manifest that the art of designing interlaced ornaments came originally from the East, where it is still practised. The interlaced work on Nestorian MSS. might be mistaken for the illuminations out of an Irish one of the eighth century,"

If the Danann tribe (Phœnicians) occupied the greater part of the island for some 197 to 300 years, how comes it, (it may be asked), that no ruins of temples such as the Sidonians were known to possess, can be pointed out in proof of such occupation? Permit me to say in reply to this query, is it probable Heathen temples would be permitted to exist while Christian edifices were required for churches and monasteries? We know, in numerous instances, the material used in monastic buildings was converted to the purpose of erecting the castles and strongholds whose ruins are to be seen everywhere.

In Kiltinan, which is still inhabited, a female form may be noticed, one hand grasping a dagger, the other a crescent. The stone, thus engraved, was evidently derived from an older building Not far from this, about a mile or so from Mr. Cook's demesne, when examining the remains of a ruined chapel or church, I discovered built into the walls, a block containing the raised, rudely sculptured form of a nude Astarte, perhaps. I am not aware if this interesting relic has been noted previously. I cannot entertain a doubt that it must have been taken from some Pagan Temple, although a brother officer of mine suggested that it might have been intended as a representation of Eve before the fall.

An inscribed stone, which had disappeared since the time of Charles I., was quite recently discovered built into the pier of an old gate with the inscription face turned inwards. It would be tedious to enumerate where and under what circumstances many of our ogham Celtic pillars were recovered.

From the many monuments ascribed to the Dananns, coupled with the historical tales and traditions respecting them, Dr. O'Donovan considers they were a real people. It may be inferred they were skilled in arts unknown to their successors, "they could work diabolicale things by magick, and were accompted the chiefest magicians in the world." The learned antiquarian concludes that they may have lingered in retired situations in Ireland for many centuries after their subjugation by the united efforts of the Bag-men and Milesians apparently. He adds, "It appears to be

strange that our genealogists trace the pedigree of no family to this people, while we have several families of Fir-bolg descent mentioned." The circumstance stated may lead some to infer they were a different or distinct race, and possibly were exterminated or expelled by the combined Celts. Had they been observed in the population subsequently we may discover some peculiar idiom or root derived from a foreign source. We must leave this to some future Max Müller. The Persian word khan has the same meaning as cean in Erse. The Eastern origin of the latter seems evident. Crom of Pagan Ireland is the Egyptian chrom. While you may permit me to point to a few weapons and ornaments attributed to this wonderful people, I may mention they are credited with having conveyed from the East the "lia fail," or stone of destiny, in the coronation chair, which Protestant England holds sacred, believing it to be the identical pillow of Jacob, which he set up as an altar! Instead of newly upholstering that blessed old antique, as was done lately to modernize it for Her Gracious Majesty's descendants, it would be more judicious, perhaps, to have handed it over in its original condition to the safe custody of the British Museum than retain it where it now is, as a monument of medieval English superstition in this enlightened age. The Established Church may rest assured few of us would feel inclined to claim such a Celtic relic as this.

The succeeding wave of humanity that swept over Europe and left their footprints indelibly impressed on every prominent mountain chain, on the banks of the principal rivers also, was derived apparently from the east. It is remarkable that two emigrations are referred to, one towards the north, the other westerly by Gibraltar. The latter is what we are concerned about, since the majority of the Irish people and nearly all the inhabitants of the Scottish Highlands derive descent from the Scythio-Iberian colonists, known to us as Milesians. It is probable that Spain had a Celtic population before the arrival of the latter there. I can see no reason to doubt the bardic accounts, because some critics think it hard to imagine a wandering tribe, at such an early period, having a knowledge of navigation which would enable it to find a way across the sea from Galicia to Ireland. They admit that Phœnicians and Greeks were navigators, using sail vessels thousands of years ago; that ships (not mere boats or canoes), are undoubtedly represented on the tombs of Egyptian Kings. But Oh! it would seem too much to ask them to

believe our Celtic ancestors were acquainted with any vessels, save such as were formed out of the hollowed trunks of trees, or hide covered corrochs. The Latin poet Claudian knew better, when referring to Niall's successful expedition into Gaul, then a Roman province, he states: "*Totam cum Scotus Iernem movit et infesto spumavit remige Tethys.*"

The chronology of our pre-Christian annals is obviously erroneous, but this does not affect their general authenticity. In this I most cordially concur, since Protestant and Catholic fellow countrymen alike, accepted the writings of Moses, the Jewish priest of Isis, learned in all the Egyptian Mythology.

Round Towers.—No Celtic remains have been the cause of such angry controversy and difference of opinion among antiquarians as the extraordinary structures which I believe are peculiar to Scotland and Ireland:—

> "These grey, old pillar temples,
> The conquerors of time."

As regards their origin and use, that remains an unsettled point. Some consider they were pre-Christian sepulchral monuments, Sun, or Baal towers, or dedicated to Pagan purposes. Among the individuals holding these, or closely allied views, may be named General Vallancy, Dr. Lanigan, the Librarian of Stowe, Sir Wm. Betham and others. The advocates of the purely Christian origin were Sir R. C. Hoare, Petrie, O'Donovan. The latter was the dead antiquary referred to by poor D'Arcy McGee:—

> "Kings that were dead two thousand years,
> Cross-bearing chiefs and Pagan seers,
> He knew them all!
> And bards whose very harps were dust,
> And saints whose souls are with the just,
> Came at his call!"

The celebrated prize essay on the subject by Petrie leaves the matter still undecided. No doubt during the Danish invasion they were used as safe retreats. Human remains have been found inside as well as outside. The sculptured crosses over the door-way noticed in a few instances may have been carved long after the building itself was raised. That they are frequently contiguous to monastic establishments may be admitted, and the circumstance does not seem of much importance when we reflect that Christian edifices

would naturally arise in the close vicinity of the towers when converted to religious uses. It seems remarkable that no mention is made of such wonderful buildings until the introduction of Christianity.

The popular idea respecting the builder, no doubt, may have some foundation, but the Gobhan Saer could not have been the architect of all. Some are far more ancient than others. Lightning destroyed many, of which not a vestige remains, and man's hand, and I may add, unfortunately, neglect, proved yet more destructive than even the elements. However, the Royal Antiquarian Society of Ireland will in future look to the preservation of the ones yet remaining. Several have been already repaired, even previous to its recent reorganization.

Evidence can be produced in proof that one at least was erected in the sixth century and another restored in the twelfth. But no trace of the latter now remains. Taking into account that we have no proof that the principle of the arch or mortar was known before the introduction of the Christian religion, I am inclined to agree with Petrie and O'Donovan.

Weapons of the Milesians.—We possess no reliable description regarding the weapons of these colonists previous to the introduction of Christianity. The battle axe and sword were in use from a very remote time as well as the sling and bow. In the priceless illuminated MS. of the Gospels now in Trinity College, called the Book of Kells, old as the sixth century, you may notice a warrior holding a spear. The head above the shaft is coloured blue (steel); it is a peculiar shape, quite unlike the bronze ones of an earlier time. The figure displays the round target of the Highlander in his left hand. This circular shield with the central boss, may also be remarked on the most ancient of the sculptured crosses. These sculptures frequently commemorate battles and other incidents. In some cases are horses, chariots, fighting groups of soldiers—of these two are armed with spears and crescent-like shields, opposed to others with the long hacking Danish or Irish sword. The figures have suffered so much from the weather, and wanton injury as well, that it is no easy matter sometimes to trace the outlines. One, dressed in the kilt, was said by a guide to represent Adam. So you see the Celts may claim the primitive costume as well as the primitive language, else small reliance can be placed on tradition.

In a hurried examination of the Irish swords (claideam), claymores which came under my observation, I found it exceedingly difficult to distinguish Danish from Celtic, or the latter from early Norman. If we reflect that for some 300 years the inhabitants of Ireland waged an almost incessant warfare with the Baltic Vikings, both Fingalls and Dubhgalls (fair and dark foreigners), and subsequently with the Norman-Welsh invaders, with varied success, you may readily perceive how the difficulty arises. The victors on a battle-field would naturally collect and appropriate the arms obtained in war, handing them down as heir-looms. In several of the illuminated Celtic MSS. and monumental remains, the long cross-handled sword, used for cutting and stabbing, is often represented. I am not disposed to accept altogether the views of some antiquarians—that the mere guard for the fingers and hand is quite sufficient to enable us to pronounce positively, this weapon is Irish, that Danish.

Many years ago, when I was Regimental Adjutant of H. M. S. Bedfordshire Regiment, at Corfu, a discussion arose after dinner at the table of Captain Domville, R. A., (an Irishman too), a very distinguished general officer in after times. The subject of discussion was the origin of the Highland claymore. "Well, gentlemen, if you will excuse me for a few seconds," said our host, laughingly, "we may allow the old Italian himself to have a word in the matter." He returned shortly after with a magnificent Andrea Ferrara claymore in remarkably fine preservation, with the maker's name inscribed or engraved on the blade. My grandfather, who left Monymusk, Aberdeen, about 1740-45, considered such an inscription the only test of a genuine Ferrara. The majority of the basket-hilted swords in the Highlands were not made by the famous Italian artificer, and are merely modern imitations of his handiwork.

I am inclined to believe the celebrated armourer borrowed the idea of the hand-guard from a yet more ancient Milanese craftsman. My son-in-law, Mr. George Duggan, is in possession of a Milan sword I obtained at the Ionian Islands, bearing a close resemblance as regards blade and guard to the Scottish weapon. I presume it dates from the time when the Venetians ruled the Adriatic. The handle plate remains complete, but a small fragment of silver was attached to a rivet, proving conclusively that the metal ornaments had been removed.

A sword found in an old slated house, which was said to have

been occupied by one of Cromwell's officers, was given to me by the finder. The handle was dark, not black, oak; the guard steel, with brass or bronze pommel; the blade a long cutting one, point broken off. It did not widely differ from the swords of the Ironsides. It is doubtful if it could be classed as a Celtic relic.

Glass Urns, Ornaments, Beads.—It can hardly be denied that glass was known to the Pagan Irish at an early period. The mortuary urns, the numerous enamelled beads and other ornaments, the fusion of colors, the extraordinary skill displayed in blending them so as to produce designs in relief, lead one to imagine, until he examines carefully, that he is only admiring some very exquisite ancient cameos of Etruria.

It may be urged that the peculiar spiral decoration, exhibited in many instances, is essentially a Celtic characteristic, and that it is well displayed on the carved monumental slabs of our Irish pyramids at New Grange and its vicinity. This inference points to a pre-Milesian origin. We have no means of ascertaining whether they were manufactured in Ireland or acquired by barter or plunder from an unknown Eastern source. English writers allege that bottle and window glass only were manufactured in Great Britain for the first time in the reign of Queen Elizabeth, and that the latter was only used, with few exceptions, in palaces and churches. Surely, if a knowledge of making colored glass existed in Ireland in early Christian times, such a production could not well have escaped the observation of the monkish scribes, whether Celtic or Saxon. An Eastern people, and a highly civilized one too, were alone capable of producing such perfect forms and beautiful designs. The stained glass presented to the Academy by the Dean of Clanmacnoise (Dr. Butler), from the primitive monastery of Trim, existing at the close of the twelfth century, was imported probably from South Europe, but the exquisite bead of white enamel, with the pale blue spiral lines passing around it, discovered at same locality, with gold and silver brooches, may be more ancient.

Royal Purple and other Dyes.—Not a few clergymen, as well as laymen, contend that the knowledge of dyeing textile material, which the ancient Irish undoubtedly possessed, may have been acquired with the lost arts from the scattered tribes of Israel. The process of colouring was known to them apparently before this separation

took place, but there is every reason to suppose the Irish people learned the secret from their neighbors at a very early period.

The mortars, or stone vats used for dyeing, cut from the rocks near ancient Tyre, were discovered by Dr. Wilde half a century ago. He noticed fragments of a small murex (M trunculus) cemented together, lying at the bottom of the caldrons and heaps of the same shell close by. Pliny, the Roman naturalist, who witnessed the process of dyeing, has left us an interesting account of it. But the shell which he calls a purpura (purple), was a murex not a buccinum. The true purpura produces a crimson dye. The difference in the appearance of both is exceedingly slight. Woodward and other conchologists held quite recently the same view as Pliny respecting a purpura.

The royal Tyrian dye, Pliny states, owed its rich color also partly to another mollusc, a species of patella (limpet), perhaps the blue so common on the shores of the Adriatic. If the purple sea snail, it would be difficult to understand how such an accomplished naturalist could have confounded Ianthina fragilis, a free floating shell, with the stationary one attached to rocks and unlike it in every respect. The snail shell is so exceedingly thin it is not likely even a fragment would have remained in the dye pots, whereas the patillidæ are of considerable thickness, and must have been easily recognized in the conglomerate.

Referring to an extract from Montague's "Testacea Britannica," and also to a tradition that the Phœnicians obtained their colors from South England and Ireland, Dr. Wilde gives us the result of some experiments he made with regard to extracting coloring matter from testacea: "The animal used was buccinum lapillus, and afterwards turbo clathrus, tons weight of which may be collected on the rocks at Howth and Malahide. The fluid will be found in a receptacle in a sulcus, behind the neck, of worm-like appearance. On applying it to silk, woollen or cotton texture, in a few seconds it assumes a straw color, then light green—margin becoming pink; red deepens into vivid purple, which washing increases in lustre and intensity. It must be exposed, however, to solar light. It is an animal indigo, containing a mordant in itself. Mineral acids affect it; the color fades at death (unlike cochineal), and grows fainter if the animal is kept long out of its natural element." Walker, in enumerating the colors used by the ancient Irish in remote ages,

remarks: "There is a beautiful crimson obtainable from the periwinkle and a species of limpet," and Plancus asserts, "The turbo clathrus yields the Syrian purple.

Dress, Ancient Celts.—Although the woollen manufacture of Ireland was well known and duly appreciated at the beginning of the thirteenth century, and we have conclusive evidence of its fabrication long before then, we really know but little regarding the costume itself of the various classes. I have no doubt the illuminated MSS. represent approximately, not only the color but the shape of the dress as it appeared to the respective scribes. A human body, in remarkable preservation, clad in deer-skin tunic, was discovered in 1821 in a peat-bog at Gallagh, Galway, the head, legs and feet uncovered. It was replaced, exhumed some years after, and deposited in the Dublin Society in 1829; the teeth, hair long and dark, and beard were perfect; a portion of the dress now in Dublin was submitted for microscopical examination to Professor Queckett, but he was unable to determine whether it was made from the hide of the extinct elk or not. A skin cap of dark fur, otter I think, is or rather was, in a gallery of the museum; it belongs to Mr. Walker's collection. No doubt even long after textile fabrics were in general use leather or deer-skin shirts would have been worn by swineherds and hunters. In the Western Islands off Connaught, the inhabitants wear moccasins yet of untanned hide, fastened in sandal fashion; they readily adapt themselves to the shape of the foot when they become hard and firm; they are better suited for cliff-climbing and far more comfortable to the wearer than an ordinary shoe. The hair is on the outside; they are in all respects like the description given of the ten thousand pairs of brogues left behind by the Scottish army, when by an extraordinary forced march they baffled the pursuit of King Edward III., leaving their worn-out foot-gear as the only trophy of the inglorious expedition. (See Planche's History of British Costume.) Many of the shoes and half-boots in the Irish collection are handsomely ornamented, especially the tan ones; some are stitched with gut, others with woollen thread, and later with flax or hemp. In some instances the buskins were found attached to the tight-fitting trews (trousers) as in the case of the body of the man discovered in the bog at Killery, Sligo; he was dressed in woollen costume. The material itself was used for the purpose probably by the primitive colonists, but we have no authentic foundation for the opinion.

The figures in the Book of Kells, an illuminated MS. (vellum), supposed to date from the sixth century, are generally believed to afford us the earliest representation of Celtic costume of certain classes of this period. A foot soldier, clad in a green tunic, light blue and red trews, armed with steel-headed spear and round shield, appears as if kneeling to receive cavalry. A subsequent page of the same work displays horsemen riding on horses covered with yellow trappings or coverlets; the cloaks or mantles are green also (the national color), but neither saddle nor arms are represented in the folio; so they do not offer us much assistance in endeavouring to ascertain whether they are intended to display mounted warriors or civilians of the age—in the absence of weapons, perhaps, the latter. In the vellum MS., called the Book of Ballymote, A. D. 1396, the dress of the figures is a close-fitting tunic fastened at least in one instance with a belt. There are not many representations of any but ecclesiastical costumes on sculptured monuments or shrines.

In the Book of Rights we read of the tributes paid by the several states or petty kingdoms. This valuable work, translated by Dr. O'Donovan, is now accessible, and may be considered a reliable authority on costume at a period before the Norman invasion. We there find mention made of the hooded cloaks, speckled with white borders, red, blue and green, trimmed with purple—purple of four points—with golden borders. The seann, or mantle, a white woollen locse shirt, Dr. O'Donovan thinks was used over armour. The Chief of Cinel Eanna was entitled to receive, among other tributes, five mantles and five coats of mail; the King of Tulach Og fifty mantles and fifty coats of mail, the seanns of deep purple in this instance. O'More, taken prisoner by the Earl of Ormond in A. D. 1600, is represented as wearing a short red cloak fringed at the neck, the conical Phrygian cap and tight trews.

The illuminated copy of Giraldus presents a portrait of Dermot MacMurrough; it agrees exactly with the description given in our native annals, and may be deemed quite authentic. He bears the double-handed battle axe, an unusual weapon at that time. The dress of the middle classes of England in the time of King Edward III. was a tunic with tight sleeves, tight pantaloons, short boots; precisely similar to that worn by the King of Leinster. It is quite possible he may have received and adopted the garb presented by his liege lord, in acknowledging the feudal supremacy of the

Norman monarch. I feel inclined to question if it can be proved to be the usual costume of a Provincial King of the time stated.

The dress of the higher order of the native Irish of the fifteenth century, save the conical cap of sheepskin, which fell to pieces when exposed to the air, is well displayed by a photograph taken from the garments themselves. The costume of an Irish chief of the century succeeding is supposed to be represented on a chimney-piece in the old castle of Dunkerron, near Kenmare; the O'Sullivan More wears a tunic belted at the waist, his cap a Glengarry bonnet with a twisted border and feather. The late W. Smith O'Brien obtained a cap of woven texture; it was found in a Kerry bog some ten feet deep, at the foot of a large tree; the gold band which was attached is absent now, and the present colour is probably due to the bog's tanning process. A woman's dress of woollen cloth, found in Shinrone bog, is in extraordinary preservation, and from its singular shape seems to have been lying there for about 500 years.

The curious fresco on the wall of Knockmay, Tuam, painted by O'Eddichan for O'Kelly, A. D. 1400, represents the dress of an Irish archer of the period; one is bare-headed, the other wears the conical Phrygian cap, a short green tunic and braccæ, fitting closely to the figure; the arrows carried in the belt loose.

The costume of Manus O'Donnell, A. D. 1542, before he surrendered his native title for the Earldom of Tyconnel, is described by the Lord Deputy Sentleger in a State paper yet existing:—"It consisted of a coat of crimson velvet, with twenty or thirty pairs of golden aiglets; over that a great double cloak of crimson satin bordered with black velvet, and in his bonnet a feather set full of aiglets of gold, so he was more richly dressed than any other Irishman."

In the great battle of Clontarf, fought on Good Friday, A. D. 1014, we have not only the scalds of the Scandinavian poets of the time, acknowledging their defeat, but such records as remain unquestioned, preserved by our monkish historians as well. No unprejudiced person can deny that both bear the impress of truth. The ringed and scaled mail of the Northern Vikings is accurately described. The Irish leader, Prince Murrough, is called Kerthialfadr in the Danish accounts, which precisely agrees with that recorded in "the four masters," respecting his hewing his way to the Ostmen's standard, and cutting down two bearers in succession with his battle

axe. Geraldus Cambrensis, tutor and secretary to Prince John, has left us the following account of the Irish weapons:—"These terrible battle axes were wielded in one hand, and thus descended from a greater height and with greater velocity. Neither the crested helmet could defend the head, nor the iron folds of the armour the body—whence it has happened in our own times, that the whole thigh of a soldier, though cased in well-tempered mail, has been lopped off at a single blow, the limb falling at one side of the horse, the expiring body on the other. Besides these broad-axes, well steeled, they (the Irish) use short lances and darts, and are dexterous beyond other nations in slinging stones in battle, when other weapons fail them."

Harris Ware adds:—"Their swords were ponderous, of great length, and edged only on one side."

War Trumpets, Hunting Horns.—We have a large number of brass or bronze trumpets (corns), and clarions (stocs). The Buabhall of Vallancy, probably, was the great brazen war trumpet used by the commander only in a final rally or when he considered a supreme effort necessary to ensure victory. Geraldus Cambrensis alludes to it I think. The magnificent one in the Irish Museum, 8½ feet in length, is the finest yet discovered, and you may perceive from the extract I lately received from Dublin how admirably suited it was for sending the leaders' instructions to the most distant point of the battlefield.

In 1750 fourteen bronze horns were found between Mallow and Cork; some of them came into Bishop Pocock's possession and were sold in London. Three were figured and described by Smith in his History of Cork. The locality where some at least were discovered I am perfectly acquainted with—Mourne Abbey. It was the scene of a sanguinary fight in King Henry the Eighth's time, between McCarthy, Prince of Desmond, and the Norman Earl of the same name. The latter was defeated with great slaughter. I always considered a few of the carved trumpets in question may have been flung aside when the bearers were escaping over the bogs or mosses after their defeat. Trumpets closely resembling them have been found in England. See the rare work in our museum, kindly presented by one of our members.

While we regret that the early Monks have apparently suppressed much information respecting Pagan Ireland, we must

acknowledge on the other hand that they left behind them illuminated and other manuscripts of the greatest importance. Italy, Switzerland, Germany and England possess Irish MSS. of marvellous beauty ; one now in Milan dates from the sixth century and is of priceless value.

The strongest testimony of the truth of the bardic annals is recorded by a scientific Frenchman in his work "The Verification of Dates." He points out how an Irish monk relates eclipses of the sun as having taken place long before the introduction of Christianity into Ireland. In "The Annals of Innisfallen" he found the following entries:—A.D. 445, a solar eclipse in ninth hour. On testing this he ascertained a solar eclipse visible North-west Europe, July 28th at 5½ p. m. same date. Again, A. D., 664 (Irish MS.) darkness ninth hour (May); a total eclipse of the sun took place, visible to Europe, Africa, at 3½ p. m. 1st May of that year.

In the "Etruria Celtica" Sir William Beethan mentions that Orosius, a writer of the fifth century states that a pharos or fire tower was, according to tradition in his time, erected on the coast of Celtiberian Galicia as a guide to ships coming from Britain by Hercules. The Milesian bards claim that their forefathers sailed from Tuir Breogan, Galicia. That seems confirmatory, but they may only have followed the same course as their Phœnician predecessors, by whom the original Pharos of Bregia was erected. This granted, the circumstance leads to such a conclusion It is expressly admitted that the Aryan tribe or tribes, which subjugated the Dananns, were a rude, warlike people, inferior as regards civilization, but superior in courage; that they possessed some knowledge of astronomy, navigation and other things is evident. It is difficult to see how, engaged in incessant warfare in pre-Christian times, they could have acquired the skill to manufacture various articles with which they are credited. Take for instance, the silver shields at Airget Ross (Silver Wood) on the River Nore, B. C. 1383; the coins struck at the same place 881 B. C.; the goblets and brooches plated with gold at Foharta (the Liffey), the ranks distinguished by seven named colors in garments (tartans), in the reign of Tiernmas, B. C. 1620; the four-horsed chariots B. C. 1024. It is very singular that while the early chronicles give us accounts of the inauguration of various Irish kings there is no reference to a crown having been used for the ceremony. This circumstance led Wilde and others to conclude that the beautiful golden diadems, some or-

namented with precious stones, now in Dublin, may have belonged to statutes of the Virgin. I am inclined to acquiesce in this view generally. I am not fully satisfied respecting all. In the fresco painted for O'Kelly, of Hymany, A. D. 1400, Knockmay Abbey, the Royal personage there represented wears a crown. Donough, son to Brian Boruma, is said to have taken the Irish crown to Rome after his defeat by his nephew.

What is more natural than to suppose that through barter and intercourse they had acquired a certain knowledge of navigation from the Sidonian traders? Admitting that the traditions of the bards are very often rather mixed and conflicting, for all that it seems to me there underlies an historical page we are not justified in rejecting. I understand that both German and French antiquarians are now investigating the matter.

In alluding to Celtic dwellings I omitted to mention the artificial caves of North-east Ireland. Some are natural ones, but subsequently improved or enlarged apparently. The subterranean ones, at least in some cases, are probably the underground passages of ancient raths which have been levelled and ploughed over. I failed also to point out that bronze needles were used by the inhabitants of Ireland long before the useful article was introduced by a Negro into England in the reign of Queen Mary The gold-adorned shield or corselet (found near Lismore), which was purchased by a Cork goldsmith for £600, I presume was melted down The golden helmet from Tipperary, which Walker states was offered for sale in Dublin, very likely shared the same fate. Note that the famous Durham book now in the British Museum, date A. D. 698, although executed by Saxon monks, taught by St. Aiden, is Irish as regards design. It came from Lindisfarne.

HAMILTON ASSOCIATION.

Recent Donations to the Museum.

REPORT OF THE CURATOR, 1890-91.

Specimens of Asbestos from the Township of Elzevir, County of Hastings. E. Furlong.

Fossil Sponges from Tennessee. Dr. Head.

Specimen of Mica. T. C. Mewburn.

Silver-plated medal of the Hamilton Carnival of 1890, and a bronze medal of the International Exhibition at Philadelphia, 1876. J. Russell.

Two specimens of petrified coral from the Township of Kepple; Indian clay pipe; bone tally and bone needles. D. J. Campbell.

Three handsome stands for museum cases, and gun carriage for old Hudson Bay Co. swivel gun; a quantity of copper coins, and a piece of gum-like amber found on the coast of Zanzibar. The late S. Symons.

Photographs of Stratford-on-Avon and colored chromos of Her Majesty the Queen and the Prince of Wales. J. A. Barr.

A fine specimen of fossil from Collingwood. Master Valentine Boyd, Toronto.

A piece of rock obtained by Dr. Rae within the Arctic Circle, and a specimen of lapis lazuli. R. Russell.

A piece of mummy cloth from the Royal Egyptian Tombs B. E. Charlton.

Meteoric stone, found on a farm near Sarnia. Donated by George N. Matheson, Collector of Customs, Sarnia, through T. C. Mewburn.

Two bolts and a piece of the steel plate of the "Great Eastern" steamship. The Ontario Rolling Mills Co., per Samuel Briggs.

Fine specimens of Polyzoa, from the Pacific coast. Professor Wright, Los Angeles, California.

Glass cases of butterflies and insects, three wasps' nests, horse crab, a specimen of Amblystoma Carolina, and a fine entomological collection (loaned). J. Alston Moffat.

Specimens of Eozoona Canadense and other fossils. J. F. Whiteaves, of Ottawa.

Quantity of Wampum found in and near Hamilton and Waterdown. Colonel Grant, R. Bull and Mr. Allison.

Two large star-fish, one sea horse (Hippocampus), cup sponges, and specimens of Algae, mounted, all from Nassau. T. H. Stinson.

A horned lizard from Texas. Mr. Blachford.

Specimen of the vegetable ivory nut from which buttons are largely made. J. Bickle.

A case of English butterflies. H. Myles.

Specimen of "Candi pine gum" from Auckland, N. Z., used in making ornaments and varnish. Mrs. Birnie.

Specimens of lead in its various stages, from the crude ore to the pure metal--from the "Doe-run" lead mines of Missouri. W. D. Long.

Specimens of Peacock Copper Ore, native Copper, Manganese Iron and Iron Ore, from Western Virginia. G. H. Meakins.

A young alligator from Bermuda Mrs. R. D. Cowan.

A piece of Cleopatra's Needle, which scaled off from the effect of change of climate, after being set up in New York. A. E. Walker.

Fine specimens of fossil ferns from the coal measures, New Brunswick. Adam Brown.

The freedom of the city of London, granted to James Sees, 6th November, 1798; freedom of the city of London, granted to James Wm Sees, 3rd Oct., 1870, and certificate of discharge of James Sees from bankruptcy, dated 13th Oct., in the 54th year of the reign of George the 3rd, and signed by Lord Eldon. J. Bickle.

ALEXANDER GAVILLER,
Curator.

May 14th, 1891.

Report of the Council

OF THE HAMILTON ASSOCIATION.

Read at the Annual Meeting, held May 14th, 1891.

The session just closing has been, on the whole, a successful one, whether we consider the work done or the attendance of members.

The interest in the Association is on the increase, as evidenced by the large accession of new members during the session--no less than forty having been received, which is the largest number elected in any one session during the past history of the Association. The anticipations cherished by us in entering upon our new premises have been fully realized. The number of active members now on the roll is about one hundred and fifty.

During the year seven general meetings have been held, at which the following papers have been read and discussed, viz.:

November 13th, 1890—Address on "The Early History of Hamilton and its Neighborhood," by the President, B. E. Charlton;

December 11th—"The Surface Geology of the County of Lincoln and Neighboring Counties," by D. F. H. Wilkins, B. A., of Beamsville;

January 8th, 1891—"Egypt, with some account of the Book of the Dead," illustrated by the British Museum *fac-simile* of the papyrus of Ani, by H. B. Witton;

February 11th—"Connecting Links," by H. B. Small, of Ottawa;

March 12th—"Flutes of the time of Moses," by J. E. P. Aldous, B. A.;

April 9th—"Electricity as a Source of Light and Heat," by J. T. Crawford, B. A.;

May 14th—"Botanical Jottings," by A. Alexander.

In addition to these meetings the various sections have kept up their meetings during the year. Reports of the work done therein will be reported by the secretaries of these sections, and our respected Treasurer will tell us about the finances.

Your Council have had the matter of a "field day" before them, and desire to recommend, if the necessary arrangements

can be made, that a day be spent in the Jubilee Park at Niagara Falls on Saturday, the 13th of June next.

At the annual meeting of the Royal Society of Canada, held in Ottawa last year, our Association was ably represented by H. B. Small, Esq., of Ottawa. This year our friend Mr. Thomas McIlwraith has consented to be our delegate to that learned body at its forthcoming meeting at Montreal. Your Council feel that the Association will be most worthily represented by Mr. McIlwraith, and that he will give a good account of himself and of us.

We cannot close this report without referring to the loss we have sustained in the removal from the city of our friend Mr. Moffat, who has been so long connected with this Association, and has done so much to sustain its character and standing. Mr. Moffat is now the Curator of the Entomological Museum in London, and we ask that he be elected an honorary member of the Association.

We also regret to find that Mr. Hanham, the Secretary of the Biological Section, has removed to the city of Brantford. Mr. Hanham has really added a new department to that section, not hitherto thought of, viz., that of Conchology. His industrious collection and study of the land and fresh water shells of this neighborhood is well-known to all of us. Not only has he introduced us to a new department of Biology, but he has made several additions of new species to the Canadian list of shells. We ask that he be made a corresponding member of the Association.

We have also lost a warm and generous friend of the Association in the somewhat sudden death of Mr. Samuel Symons. His valuable collection of models of British war vessels, as also the handsome stands for the cases of our museum, as well as the platform table and President's chair, and various other articles of furniture in our museum testify not only to his taste, but also to his generosity and kindly feeling toward us.

We conclude this report by expressing the hope that the members will do their utmost to observe and note facts in their various departments during the summer recess, so that material may be at hand for the section work of the coming session.

All of which is respectfully submitted.

B. E. CHARLTON, *President.*
A. ALEXANDER, *Secretary.*

HAMILTON ASSOCIATION.

Financial Statement

For year ending May 1st, 1891.

RECEIPTS.

Balance from 1890	$276 74	
Government grant	400 00	
Members' subscriptions	160 00	
		$836 74

EXPENDITURE.

Rent and lighting	$177 55	
Printing Proceedings and notices	174 30	
Stationery and postages	42 30	
Insurance	11 88	
Commission on collecting, and caretaker	24 80	
Moving the museum furniture and specimens, and incidentals	62 85	
		493 68
Balance in bank		$343 06

RICHARD BULL,
Treasurer.

We have examined cash book and vouchers, and find them correct.

H. P. BONNY,
A. T. NEILL, } *Auditors.*

Hamilton, 14th May, 1891.

LIST OF MEMBERS

OF THE

HAMILTON ASSOCIATION.

HONORARY.

1881 Grant, Lt.-Col. C. C, Hamilton.
1882 Macoun, John, M. A., Ottawa.
1885 Dawson, Sir J. Wm., F. R. S., F. G S., F. R. S. C., Montreal.
1885 Fleming, Sanford, C. E., C. M. G, Ottawa.
1885 Wilson, Sir Daniel, LL. D., F R. S. E., Toronto.
1885 Farmer, William, C. E., New York.
1885 Ormiston, Rev. William, D. D., Pasadena, Cal.
1885 Rae, John, M. D., F. R. G S., LL D., London, Eng.
1886 Small, H. B., Ottawa.
1886 Charlton, Mrs. B. E., Hamilton.
1887 Dee, Robert, M. D., New York.
1887 Keefer, Thos. C., C. E., Ottawa.
1890 Burgess, T. J. W., M. D., F. R. S. C., Montreal.
1891 Moffat, J. Alston, London.

CORRESPONDING.

1870 Wright, Prof. W. P., M. A., Los Angeles, California.
1871 Seath, John, M. A., Toronto.
1881 Clark, Chas. K., M. D., Kingston.
1881 VanWagner, P. S., Stoney Creek.
1881 Spencer, J. W., B. Sc., Ph. D., F. G. S., Savannah, Ga.
1882 Lawson, A. C., M. A., California.
1884 Bull, Rev. Geo. A, M. A., Niagara Falls South.
1885 Frood, T., Sudbury.
1889 Yates, Wm., Hatchley.
1889 Wilkins, D. F. H., B. A., Bac. App. Sci., Beamsville.
1889 Kennedy, Wm., Austin, Tex.
1891 Hanham, A. W., Quebec.

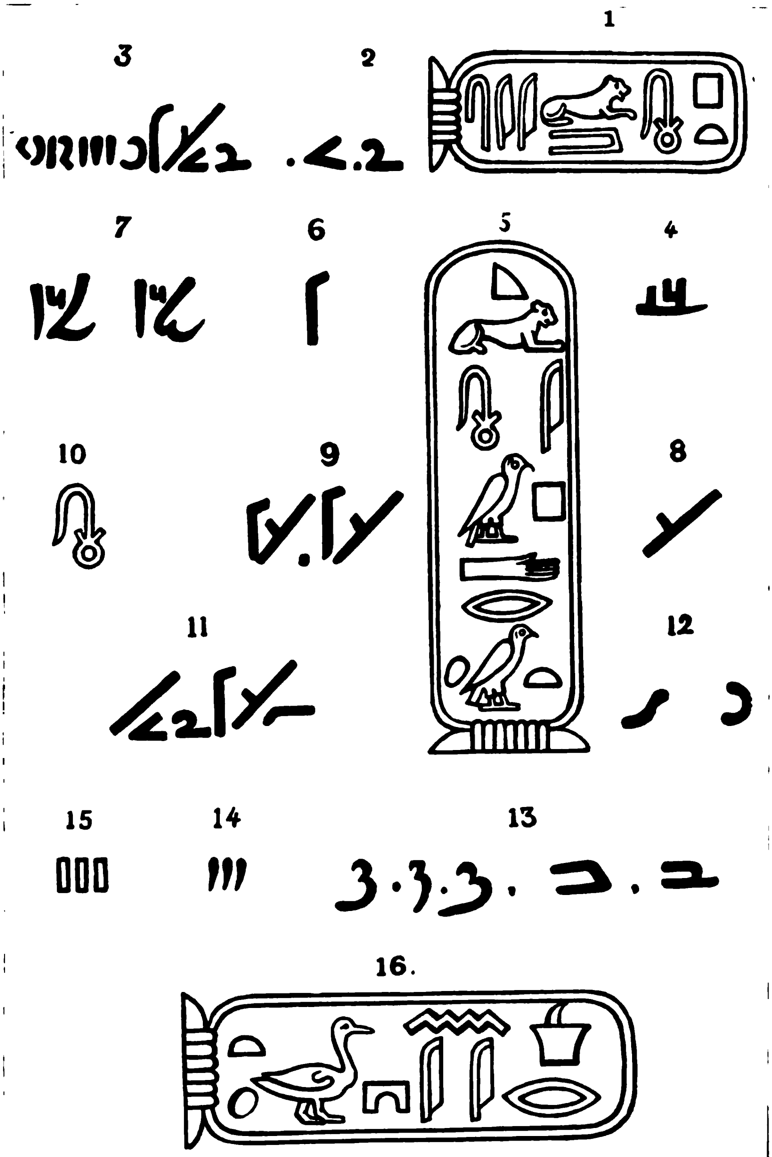
LIFE.

1885 Proudfoot, Hon. Wm., Q. C., Toronto.

ORDINARY.

1891 Aldous, J. E. P., B. A.
1872 Alexander, A., F. S Sc.
1888 Baker, C. O.
1885 Baker, Hugh C
1880 Ballard, W. H., M. A.
1880 Barr, J. A.
1881 Barton, G. M.
1891 Birkenthal, Rev. H., Ph.D
1880 Black, Geo.
1890 Bonny, H. P.
1881 Boustead Wm.
1881 Bowman, Wm.
1880 Briggs, Samuel
1857 Brown, Adam
1891 Brown, O. J., M. A.
1885 Buchanan, W. W.
1857 Bull, Richard
1880 Burns, Rev. A., D. D., LL D
1891 Burns, J. M.
1889 Campbell, D. J.
1890 Cape, John
1891 Chapman, J. R.
1880 Charlton, B. E.
1891 Cheyne, John P., Commander R. N.
1884 Childs, W. A., M. A.
1890 Clark, D., D. D. S.
1890 Cloke, J. G.
1887 Colquhoun, E. A.
1891 Crawford, J. T., B. A.
1880 Cummings, James
1872 Dickson, George, M. A
1880 Dillabough, E. H., M. D.
1890 Elliott, W. H., Ph. B
1881 Evans, J. DeV.
1881 Fearman, F. W.
1882 Ferres, James
1890 Finch, C S.
1880 Findlay. W. F.
1880 Fletcher. Rev. D. H., D.D.
1880 Forbes, A. F.
1891 Foster, F. G.
1880 Foster, W. C
1880 Gaviller, Alex.
1882 Gaviller, E. A., M. D.
1883 Gibson, Hon. J. M., M.A., LL. B.
1888 Grant, A. R
1887 Green, Joseph
1883 Grossman, Julius
1888 Galbraith. W. S.
1887 Hancock, Wm.
1882 Harris, W. J.
1891 Heming, A. H.
1889 Herald, Joseph
1887 Hobson, Thos.
1890 Holden, Mrs. J. Rose
1887 Ireland, S. J.
1882 Laidlaw, Rev. R. J., D. D.
1890 Lancefield, R. T.
1884 Lee, Lyman, B. A.
1890 Lees, Thomas
1857 Leggat, Matthew
1890 Leslie, G M.
1880 Leslie, James, M. D.
1880 Littlehales, Thomas
1891 Locheed, L. T., B. A.
1887 Logie, W. A., B. A.
1880 Lyle, Samuel, B. D.
1891 McClemont, Wm. M.
1891 McCullough, C. R.
1857 McIlwraith, Thos.
1890 McInnes, Hon. Donald
1884 McLaren, Henry
1890 McLaughlin, J. F., B. A.

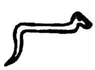
1880 Macdonald, J. D., M. D.
1857 Malloch, A. E., M. D.
1890 Marshall, Wm.
1886 Martin, Edward, Q. C.
1891 Mewburn, Thos. C.
1887 Mills, Geo. H.
1886 Milne, Alex.
1887 Moore, A. H.
1890 Moore, Chas.
1890 Moore, Henry E.
1891 Morgan, S. A., B. A.
1886 Morgan, W. S.
1887 Morris, Thos., jr.
1890 Morrison, J. J.
1883 Murton, J. W.
1870 Mullin, John A., M. D.
1880 Neill, A. T.
1887 Nelligan, J. B.
1885 Plant John
1891 Rastrick, E. L.
1891 Rastrick, F. J.
1881 Reynolds, T. W., M. D.
1890 Roach, George
1880 Robertson, Chas., M. A.
1882 Robinson, W. A.
1887 Sanford, Hon. W. E.
1890 Schofield, W. H., B. A.
1880 Scriven, P. L.
1891 Sinclair, S. B., M. A.
1885 Smart, Wm. L.
1890 Staunton, F. H. Lynch
1890 Staunton, Geo. Lynch
1890 Stratton, A. W., B. A.
1881 Tuckett, Geo. E.
1880 Turnbull, William
1891 Turner, J. B., B. A.
1881 Vernon, Elias, M. D.
1887 Walker, A. E.
1888 Williams, C. J.
1881 Williams, J. M.
1891 Witton, J. G., B. A.
1857 Witton, H. B.
1885 Witton, H. B., Jr., B. A.
1884 Young, Wm.



CARTOUCHES.

1. OF PTOLEMY. 5. OF CLEOPATRA. 16. OF BERENICE.

(The first plate in Champollion's "Systeme Hieroglyphique.")

	Signes Hieroglyphiques.	*Valeur selon Mr. Young.*	*Valeur selon mon Alphabet.*
1		BIR	B
2		E	R
3		I	I, È, AI
4		N	N
5		*inutile*	K
6		KE, KEN	S
7		MA	M
8		OLE	L
9		P	P
10		*inutile*	Ô, OU
11		OS, OSCH	S
12		T	T
13		OU	KH, SCH
14		F	F, V
15		ENE	T

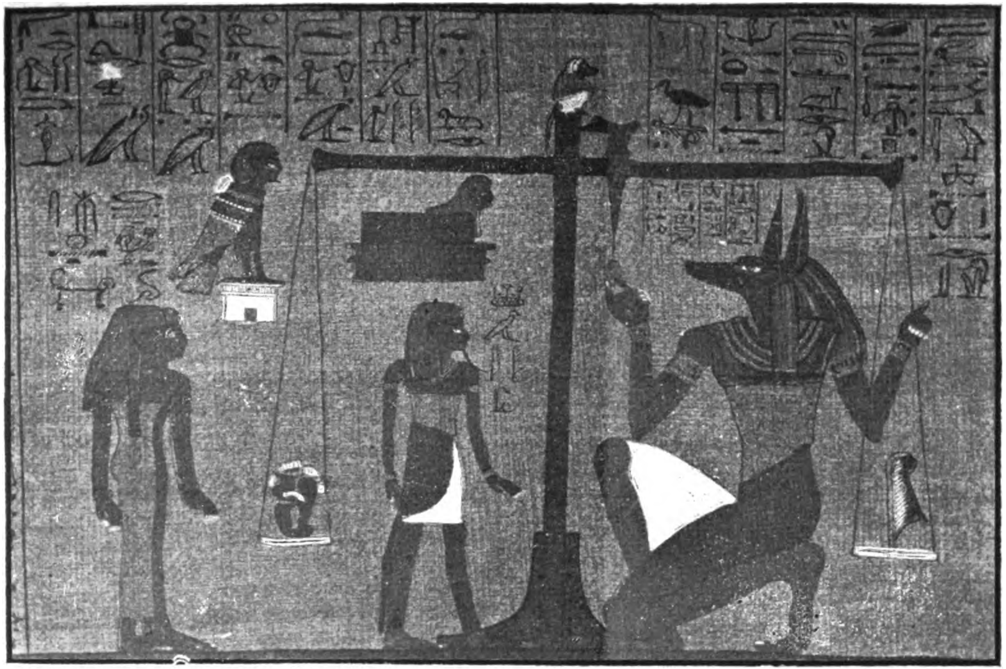
PHONETIC VALUES OF THE HIEROGLYPHS.

(From Champollion.)

ANI AND HIS WIFE

BEFORE A TABLE OF OFFERINGS.

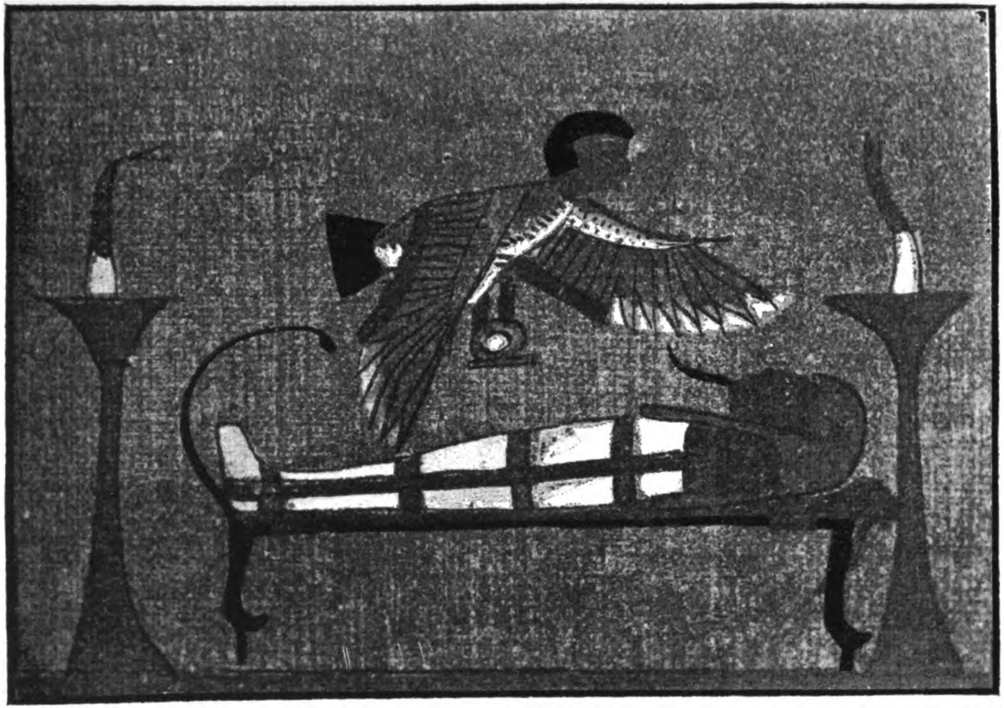
(From the British Museum fac simile.)



THE WEIGHING OF THE SOUL

BY ANUBIS AGAINST LAW SYMBOLIZED BY A FEATHER.

(From the British Museum fac simile.)



THE SOUL OF ANI

VISITING HIS MUMMIFIED BODY.

(From the British Museum fac simile.)

JOURNAL AND PROCEEDINGS

OF THE

10,307

Hamilton Association

FOR SESSION 1891-92.

NUMBER VIII.

CONTENTS

AUTHORS OF PAPERS ARE ALONE RESPONSIBLE FOR STATEMENTS MADE AND OPINIONS EXPRESSED THEREIN.

PRINTED FOR THE HAMILTON ASSOCIATION BY THE SPECTATOR PRINTING COMPANY.

1892.

8

JOURNAL AND PROCEEDINGS

OF THE

Hamilton Association

FOR SESSION 1891-92.

NUMBER VIII.

AUTHORS OF PAPERS ARE ALONE RESPONSIBLE FOR STATEMENTS MADE AND OPINIONS EXPRESSED THEREIN.

PRINTED FOR THE HAMILTON ASSOCIATION BY THE
SPECTATOR PRINTING COMPANY.

1892.

OFFICERS FOR 1891-92.

President.

A. ALEXANDER, F. S. Sc., Lon., Eng.

Vice-Presidents.

A. T. NEILL. S. BRIGGS.

Secretaries.

THOMAS MORRIS, Jr. A. W. STRATTON, B. A.

Treasurer.

RICHARD BULL.

Curator and Librarian.

ALEX. GAVILLER.

Asst. Secretary and Curator.

GEO. M. LESLIE.

Council.

COL. C. C. GRANT. W. A. ROBINSON. WM. TURNBULL.
J. F. McLAUGHLIN, B. A. T. W. REYNOLDS, M. D.

Museum.

PUBLIC LIBRARY BUILDING,
Main Street West.

OFFICE-

	President.	1st Vice-Pres.	2nd Vice-Pres.
1857	Rev. W. Ormiston, D.D.	John Rae, M. D., F. R. G. S.	J. B. Hurlburt, M. A., LL.D.
1858	John Rae, M. D., F. R. G. S.	Rev. W. Ormiston, D.D.	J. B. Hurlburt, M. A., LL.D.
1859	Rev. W. Ormiston, D.D.	J. B. Hurlburt, M. A., LL.D.	Chas. Robb........ ..
1860	Rev. W. Inglis, D. D...	T. McIlwraith	Rev. W. Ormiston, D. D.
1861	Rev. W. Ormiston, D.D.	J. B. Hurlburt, M. A., LL.D.	Rev. W. Inglis, D. D.
1871	W. Proudfoot.........	Judge Logie	Richard Bull ....
1872	Judge Logie	H. B. Witton, M. P....	Richard Bull ....
1873	H. B. Witton, M. P....	J. M. Buchan, M. A....	A. T. Freed..........
1874	H. B. Witton, M. P....	J. M. Buchan, M. A....	A. T. Freed..........
1875	H. B. Witton	J. M. Buchan, M. A....	W. H. Mills ....
1880	T. McIlwraith	Rev. W. P. Wright, M. A.	H. B. Witton........
1881	J. D. Macdonald, M. D.	R. B. Hare, Ph. D.....	B. E. Charlton.......
1882	J. D. Macdonald, M. D.	B. E. Charlton........	J. A. Mullin, M. D....
1883	J. D. Macdonald, M. D.	B. E. Charlton........	H. B. Witton . ...
1884	J. D. Macdonald, M. D.	H. B. Witton	Rev. C. H. Mockridge, M. A., D. D.
1885	Rev. C. H. Mockridge, M. A., D. D.	Rev. S. Lyle..........	W. Kennedy........ .
1886	Rev. C. H. Mockridge, M. A., D. D.	Rev. S. Lyle..........	Matthew Leggat .....
1887	Rev. S. Lyle, B. D.....	B. E. Charlton........	W. A. Childs, M. A. .
1888	Rev. S. Lyle, B. D.....	T. J. W. Burgess, M.B., F. R. S. C.	W. A Childs, M. A...
1889	B. E. Charlton.......	T. J. W. Burgess, M.B., F. R. S. C.	J. Alston Moffat .....
1890	B. E. Charlton........	J. Alston Moffat.......	A. T. Neill...........
1891	A. Alexander, F. S. Sc.	A. T. Neill	S. Briggs............

BEARERS.

Cor. Sec.	Rec. Sec.	Treas.	Libr. and Cur.
T. C. Keefer, C. E.	Wm. Craigie, M.D.	W. H. Park.......	A. Harvey.
T. C. Keefer, C. E.	Wm. Craigie, M.D.	W. H. Park.......	A. Harvey.
T. C. Keefer, C. E.	Wm. Craigie, M.D.	W. H. Park.......	A. Harvey.
Wm. Craigie, M.D.	Wm. Craigie, M.D.	W. H. Park.......	Chas. Robb.
Wm. Craigie, M.D.	Wm. Craigie, M.D.	W. H. Park.......	T. McIlwraith.
J. M. Buchan, M.A.	I. B. McQuesten, M. A.	W. G. Crawford...	T. McIlwraith.
J. M. Buchan, M.A.	I. B. McQuesten, M. A.	W. G. Crawford...	T. McIlwraith.
Geo. Dickson, M.A.	Geo. Dickson, M.A.	Richard Bull	T. McIlwraith.
Geo. Dickson, M.A.	Geo. Dickson, M.A.	Richard Bull	T. McIlwraith.
Geo. Dickson, M.A.	Geo. Dickson, M.A.	A. Macallum, M.A.	T. McIlwraith.
R. B. Hare, Ph. D.	Geo. Dickson, M.A.	Richard Bull	A. T. Freed.
Geo. Dickson, M.A.	A. Robinson, M. D.	Richard Bull	W. H. Ballard, M. A.
Geo. Dickson, M.A	Wm. Kennedy....	Richard Bull	W. H. Ballard, M. A.
Geo. Dickson, M.A.	Wm. Kennedy....	Richard Bull	W. H. Ballard, M. A.
Geo. Dickson, M.A.	A. Alexander	Richard Bull	Wm. Turnbull.
Geo. Dickson, M.A.	A. Alexander	Richard Bull	A. Gaviller.
Geo. Dickson, M.A.	A. Alexander ... . F. S. Sc.	Richard Bull	A. Gaviller.
H. B. Witton, B.A.	A. Alexander ..... F. S. Sc.	Richard Bull	A. Gaviller.
H. B. Witton, B.A.	A. Alexander ..... F. S. Sc.	Richard Bull	A. Gaviller.
H. B. Witton, B.A.	A. Alexander ..... F. S. Sc.	Richard Bull	A. Gaviller.
H. B. Witton, B.A.	A. Alexander .. .. F. S. Sc.	Richard Bull	A. Gaviller.
Thos. Morris, Jr..	A.W. Stratton, B.A.	Richard Bull	A Gaviller, and G. M Leslie.

MEMBERS OF COUNCIL.

1857—Judge Logie; Geo. Lowe Reid, C. E.; A. Baird; C. Freeland.

1858—Judge Logie; C. Freeland; Rev. W. Inglis, D. D.; Adam Brown; C. Robb.

1859—Rev. D. Inglis, D. D.; Adam Brown; Judge Logie; C. Freeland; Richard Bull.

1860—J. B. Hurlburt, M A., L.L.D.; C. Freeland; Judge Logie; Richard Bull; Wm. Boultbee; Dr. Laing.

1871—Geo. Lowe Reid, C. E.; Rev. W. P. Wright, M. A.; A. Macallum, M. A.; A. Strange, M. D.; Rev. A. B. Simpson.

1872—Judge Proudfoot; Rev. W. P. Wright, M. A.; John Seath, M. A.; H. D. Cameron; A. T. Freed.

1873—Judge Logie; T. McIlwraith; Rev. W. P. Wright, M. A.; A. Alexander; I. B. McQuesten, M. A.

1874—Judge Logie; T. McIlwraith; Rev. W. P. Wright, M. A.; A. Alexander; I. B. McQuesten, M. A.

1875—Judge Logie; T. McIlwraith; Rev. W. P. Wright, M. A,; A. Alexander; I. B. McQuestion, M. A.

1880—M. Leggatt; I. B. McQuesten, M. A.; A. Alexander; Rev. A. Burns, M. A., L. L. D., D. D.

1881—T. McIlwraith; H. B. Witton; A. T. Freed; Rev. W. P. Wright, M. A.; A. F. Forbes.

1882—T. McIlwraith; H. B. Witton; A. T. Freed; A. F. Forbes; Rev. C. H. Mockridge, M. A., D. D.

1883—A. Alexander; A. Gaviller; A. F. Forbes; T. McIlwraith; R. Hinchliffe.

1884—A. Gaviller; A. F. Forbes; T. McIlwraith; R. Hinchcliffe; W. A. Robinson.

1885—W. A. Robinson; S. Briggs; G. M. Barton; J. Alston Moffat; A. F. Forbes.

1886—J. Alston Moffat; Samuel Slater; Wm. Milne; James Leslie, M. D.; C. S. Chittenden.

1887—J. Alston Moffat; James Leslie, M. D.; P. L. Scriven; Wm. Milne; C. S. Chittenden.

1888—J. Alston Moffat; B. E. Charlton; T. W. Reynolds, M D.; S. J. Ireland; Wm. Kennedy.

1889—T. W. Reynolds, M.D.; S. J. Ireland; William Turnbull; A. W. Hanham; Lt-Col. Grant.

1890—Col. Grant; A. W. Hanham; W. A. Robinson; A. E. Walker; Thomas Morris, Jr.

1891—Col. Grant; W. A. Robinson; J. F. McLaughlin, B. A; T. W. Reynolds, M. D.; Wm. Turnbull.

CONSTITUTION AND BY-LAWS

As amended by resolution passed April 14th and May 12th, 1892.

NAME AND OBJECTS.

1. The main objects of the Hamilton Association shall be the cultivation of Science, Literature and Art, the formation of a Museum, Library, and Art Gallery, and the illustration of the Physical Characteristics, Natural History and Antiquities of the country.

MEMBERS.

2. Members shall be of three classes, Ordinary, Corresponding, and Honorary. Both ladies and gentlemen shall be eligible for membership.

3. Ordinary members are those who pay an annual contribution of two dollars; a payment of twenty dollars shall entitle to ordinary membership for life.

4. Corresponding members are those who reside at a distance from the city and contribute to the objects of the Association. They shall have all the privileges of ordinary members, with the exception of being eligible for office. They may at any time become ordinary members by the payment of ordinary membership fees.

5. Honorary members must be men eminent for their literary or scientific attainments. They shall be exempt from payment of fees; they may attend the meetings of the Association, and shall be furnished with copies of the Journal and Proceedings, but shall not hold office.

6. Proposals for the admission of members may be made at any regular meeting, and decided by vote at the next regular meeting.

OFFICE-BEARERS.

7. The Officers shall be a President, two Vice-Presidents, a Corresponding Secretary, Recording Secretary, Treasurer, Librarian and Curator of the Museum, and Assistant Secretary and Curator, who, together with the Past Presidents resident in the city, the

chairmen of all working sections and five elected members, shall form the Council.

8. The Office-bearers and five members of the Council shall be elected at the regular meeting in April of each year. They shall enter upon their duties at the annual meeting in May, and shall continue in office for one year or until their successors are appointed. They may be re-elected to the same or any other office.

MODE OF ELECTION.

9. The Office-bearers and the Committee shall be elected in the following manner, after *viva voce* nomination: Each member shall write the name of the person he selects for the office, and put the paper, without signature, in the ballot box. The Secretaries, or two Scrutineers, specially appointed, shall report the number of votes for each nominee, and the person having the majority of votes shall be elected. In case there are more than two nominees for one office, and no one has a majority of the total nnmber of votes, the one having the smallest number of votes shall be struck off the list and a fresh ballot taken.

MEETINGS.

10. The Association shall meet on the second Thursday of every month, from November to May inclusive, at eight o'clock p.m., unless otherwise ordered by the Council—five members to constitute a quorum.

11. Special meetings may be held at any time, on the call of the President, in his own right, or on the requisition of three members, for the transaction of any stated business.

12. A majority of votes cast shall determine every question.

13. The President, or chairman of the meeting, shall have a casting vote in addition to the ordinary vote.

SECTIONS.

14. To allow those members of the Association, who devote attention to particular branches of science, fuller opportunities of meeting and working together with fewer formal restrictions than are necessary at the general meetings of the Association, Sections may be established in connection with any of the branches of learning coming within the scope of the Association. There shall be for each section a Chairman to preside at the meeting, and a Secretary who shall prepare for the last meeting in May in each year, a report of

the proceedings of the section during the year. Meetings of the sections may be called at any time by the Chairman. No person who is not a member of the Association shall have the privilege of joining any of the sections.

ALTERATIONS.

15. No alteration or addition to the Constitution or By-laws of the Association shall be made unless carried by a two-thirds vote at two successive regular meetings.

16. No alteration in the Constitution can be considered, except on the written motion of three members.

17. Should the Association at any time become inactive, the Library and Museum shall be preserved entire and deposited with some scientific or educational institution in the city.

PAYMENTS.

18. The membership fee of two dollars shall be payable within one month after the election of each member, and annually thereafter.

19. No ordinary member, in arrears for one year, shall be entitled to vote, or be eligible for office, and if, after two years, his annual fees remain unpaid, he shall, *ipso facto*, cease to be a member.

OFFICE-BEARERS.

PRESIDENT.

20. The President, when in the chair, shall inform the Association of the proceedings of the Council since the last report, receive and read motions and cause the sense of the meeting to be taken on them, preserve order, and direct the proceedings of the meeting in the regular course. An appeal may be made from any of his decisions to the meeting.

21. A Vice-President, in the absence of the President, shall preside, perform his duties and have his privileges.

22. In the absence of the President and both Vice-Presidents, a Chairman for the meeting shall be chosen by those present.

SECRETARIES.

23. The Corresponding Secretary shall conduct all the general correspondence, preserve letters received and copies of letters written by him, announce the receipt of all letters and papers, and read such as the Council or Association may require.

24. The Recording Secretary shall take minutes of the proceedings at the meetings of the Association and the Council, which, when read at the next meeting, and approved, shall be entered in separate minute books. He shall issue notices of the meetings of the Association and Council, in the former case, two days, in the latter, one day before the meeting, and shall notify members of their election.

25. The two Secretaries shall edit the Journal and Proceedings of the Association at the close of each session.

TREASURER.

26. The Treasurer shall have charge of the funds, under the direction of the Council. He shall collect annual membership fees, pay accounts approved of by the Council, make correct entries of income and expenditure, and submit a statement thereof to the Annual Meeting.

AUDITORS.

27. Two Auditors shall be appointed at the meeting, on the second Thursday in April, tó examine the Treasurer's books and vouchers, and report to the annual meeting.

LIBRARIAN AND CURATOR.

28. The Librarian and Curator shall have charge of the Library and Museum, under the direction of the Council. He shall make a catalogue of the books, for circulation and reference, in the Library, and of the specimens in the Museum, naming the donors.

29. Any member may obtain from the Librarian any book, not a book of reference, and may retain it for two weeks, when, if no other member has applied for it, he may retain it for another fortnight.

30. Members shall have access to the Library to consult books of reference, at such times as may be specified by the Council.

31. Special donations to the Library or Museum may be accepted on special conditions.

32. Duplicate specimens in the Museum may be exchanged by order of the Council for equivalents.

33. Every member shall have access to the Museum, at the times specified by the Council, and any member may introduce visitors.

34. No case shall be opened without the sanction and presence of the Curator.

COUNCIL.

35. The Council shall have the management of the funds and property of the Association. The shall keep minutes of their proceedings, and report regularly to the Association ; at the annual meeting they shall present a report of the year's work.

36. The Chairman, in his own right, or at the request of any two members, may call a meeting, aad four members shall constitute a quorum.

37. The Council shall arrange the order in which papers, or other subjects for consideration, may be brought before the meetings of the Association.

PAPERS.

38. Any paper read before the Association and deemed worthy of preservation or publication shall become the property of the Association.

ORDER OF BUSINESS.

At the ordinary meetings the President shall take the chair at the appointed hour, or as soon thereafter as five members are present, and the following order of business shall be observed :—

1. Reading, amending if necessary, and confirming the minutes of last meeting.

2. Transaction of business arising out of the minutes, or lying over from the last meeting.

3. Announcement by the Corresponding Secretary of letters, papers, or other documents received since last meeting—and reading of such of them as may be desired.

4. Report by the Curator and Librarian of donations to the Library or Museum.

5. Giving notice of motions and general business.

6. Balloting for admission of new members.

7. Proposals of members.

8. Introduction of visitors (by any member).

9. Reading and remarks on essays and papers.

10. Announcing, as far as practicable, the business of next meeting.

ABSTRACT OF MINUTES

OF THE PROCEEDINGS OF THE

HAMILTON ASSOCIATION

DURING

THE SESSION 1891-92.

THURSDAY, SEPTEMBER 24th, 1891.

SPECIAL MEETING.

Mr. B. E. Charlton, in taking the chair, announced that the custom followed in former years, according to which the newly-elected officers did not enter upon their work until November, was not sanctioned by the constitution, and that it was through the courtesy of the new President, Mr. Alexander, that he was then presiding. This, he added, was the first of a number of special meetings arranged for by the Corresponding Secretary. The Association would during this session meet on the second and fourth Thursdays of each month.

Professor Ramsay Wright, of the University of Toronto, who had kindly consented to be present, then addressed the meeting on "Microbes—their Life and Work." He referred to the wonderful advances made in microscopical research within the last ten years, and then proceeded to describe the minute beings to which it had introduced us. They are exceedingly small (hence the term *microbe*), the unit of measurement applied to them being contained 25,000 times in an inch; in form they are quite simple, some linear, others globular. They feed on any form of dead animal or vegetable matter, and greatly assist the processes of decomposition; but sometimes establishing themselves in the living organism they cause disorders of various kinds. Under favorable conditions they multiply with amazing rapidity.

Professor Wright then described the best modes of propagating

and studying microbes, and by the aid of models and illustrations with the lime light pointed out the characteristics of the varieties associated with cholera, tuberculosis, fevers and other diseases.

Dr. J. D. Macdonald, in moving a vote of thanks to Professor Wright, referred to the many subjects of dispute between the schools which had been settled by the revelations of the microscope. The motion was seconded by Thos. McIlwraith, and carried.

The chairman having announced the subject of the next paper, the meeting adjourned.

THURSDAY, OCTOBER 8th, 1891.

SPECIAL MEETING.

B. E. Charlton in the chair.

The Council recommended that applications for membership be received at special as well as regular meetings. No objection being made, four applications were read.

Col. C. C. Grant read the paper of the evening, entitled "Notes on Fossil Silurian Plants." The paper was illustrated by a number of specimens from the Museum.

Thos. McIlwraith, delegate of the Association to the meeting of the Royal Society of Canada, in Montreal, last May, then gave an account of that meeting.

After the usual announcements the meeting adjourned.

THURSDAY, OCTOBER 22nd, 1891.

SPECIAL MEETING.

A. T. Neill, First Vice-President, in the chair.

As there was no other business before the meeting, W. H. Ballard, M. A., proceeded at once with the reading of his paper, "How We Measure." In a paper read before the Association some time since, Mr. Ballard dealt somewhat fully with the origin of our units of measurement of time, length and weight. His purpose in this was to show that our other measurements are all reducible to these three. The units of surface and volume are derived directly from that of length ; the units of capacity, density and specific gravity from those of weight and volume. The measurement of uniform or accelerated velocity implies a consideration of time and length ;

the measurement of work, weight and length; while the measurement of momentum implies all three. Force is measured by a reference to the units of time and momentum; energy may be expressed in terms of mass and velocity, or of force and space: and the various units for measuring heat, light, magnetism, electricity, and the like, are only more complex combinations of the same simple elements.

After an interesting discussion the meeting adjourned.

TUESDAY, NOVEMBER 10th, 1891.

REGULAR MEETING.

B. E. Charlton in the chair.

The minutes of the regular meeting in May and of the three special meetings in September and October were read and confirmed.

The Corresponding Secretary announced the receipt of twenty-nine exchanges and twenty-one Government reports since the last regular meeting.

C. C. Arthur, M. A., H. Carpenter, B. A., W. Chapman and J. W. Tyrrell were elected ordinary members of the Association.

Six applications for membership were received.

Messrs. Turnbull and Witton then escorted the newly-elected President, Mr. Alexander, to the chair, to which he was welcomed by Mr. Charlton in a few appropriate words. Mr. Alexander's inaugural address dealt chiefly with the study of Biology.

After the address, the Museum was thrown open for inspection; a number of microscopes were placed in the Art School rooms, and experiments were made in Pneumatics and Electricity. Mr. Aldous provided a short musical programme.

The meeting was closed by the singing of the National Anthem.

THURSDAY, NOVEMBER 26th, 1891.

SPECIAL MEETING.

S. Briggs, Second Vice-President, in the chair.

No business was transacted.

Rev. Dr. Burns read a paper entitled "A Criticism of our School System." He called attention especially to the rigidity of the system, the disregard of the individual pupil's nature, and the restrictions placed upon the teacher. Fewer subjects, he thought, should

be studied at a time, and there should be no attempt in our public school grades to exhaust all the difficulties of one subject before passing to another. The pupil's promotion should be determined by the teacher's opinion of his fitness for higher work, and no attempt made by persons otherwise unacquainted with the pupils to grade them according to their ability to answer a few questions, as at present. [The paper has since appeared in the form of a series of letters to the Toronto *Globe.*]

Considerable discussion followed, for the most part concerning the qualifications of teachers and the methods of examination.

The chairman announced the formation of two sections, one for the study of Physics and Chemistry, the other for the discussion of questions in Philosophy.

The meeting then adjourned.

WEDNESDAY, DECEMBER 9th, 1891.

REGULAR MEETING.

The President, Mr. Alexander, in the chair.

The minutes of the last regular meeting, and of the special meeting of November 26th were read and confirmed.

John M. Eastwood, W. Sanford Evans, A. E. Manning. Wm. Mole, M. R. C. V. S., Wm. Myles and A. C. Turnbull were elected ordinary members of the Association.

Two applications for membership were received.

A paper entitled "Canada: Its Canals and Waterways," was then read by H. B. Witton. The first part of the paper contained an interesting narrative of the discoveries of Cartier, Champlain, La Salle, and the Jesuit fathers in the watercourses tributary to the St. Lawrence. Next followed a brief account of the methods of trade in Canada in the early days; then of the construction of our various canals. The first of the series was constructed at the Cascades in the years 1779-83; the survey for the Sault Ste. Marie canal was made in 1797; the Lachine rapids were overcome in 1825; and the first Welland canal was opened by private owners in 1829. All these works have since been improved, some of them many times, and to them have been added the Chambly, Ottawa River, Rideau, and Trent Valley canals. The paper closed with a statement of the character and annual amount of the trade on the

several canals, and of the percentages of freight carried in different years by water and land. Mr. Witton also showed a number of slides prepared by an officer of the Canals department.

On motion of B. E. Charlton, the Corresponding Secretary was instructed to convey the thanks of the Association to the Minister of Railways and Canals for the loan of the lantern slides illustrating the paper.

Mr. Alexander was asked to represent the Association at the approaching meeting of the Fruit Growers' Association of Ontario.

The meeting then adjourned.

THURSDAY, JANUARY 14th, 1892.

REGULAR MEETING.

The President, Mr. Alexander, in the chair.

The minutes of the meeting of December 9th were read and confirmed.

Mr. Alexander gave a brief account of the meeting of the Fruit Growers' Association.

Thos. H. Smith and R. A. Thompson, B. A., were elected ordinary members of the Association.

Three applications for membership were received.

The Corresponding Secretary reported the receipt of twenty-eight exchanges.

The Curator reported a number of donations to the Museum, for which, on motion of W. A. Robinson, seconded by Richard Bull, the thanks of the Association were returned to the donors.

A resolution concurring in the recommendations of the late Prison Reform Conference in Toronto was moved by Mr. Briggs, seconded by Mr. Bull, and carried.

On the recommendation of the Council, L. Woolverton, M. A., of Grimsby, was elected a corresponding member of the Association.

S. B. Sinclair, M. A., then read his paper on "Memory." In the first part he analyzed the process of remembering, and explained the various theories held in regard to the mechanism of retention; in the second part he dealt with the practical question, how best to remember, discussing the value of mnemonics, the necessity of attention, the question of long and short hours of study, and the best methods of presenting subjects to young pupils.

Some discussion followed the reading of the paper, and after the usual announcements the meeting adjourned.

THURSDAY, JANUARY 28th, 1892.

SPECIAL MEETING.

The President, Mr. Alexander, in the chair.

The Corresponding Secretary reported the receipt of thirty exchanges.

One application for membership was received.

J. Alston Moffat then read a paper entitled "Man Scientifically Considered," seeking to show what is, what can be, and what cannot be learned by the scientific method concerning the origin of man, and what support the scientific principle gives to the assumption of an intelligent Creator manifesting himseif in nature.

After some discussion of the points raised in the paper, the meeting adjourned.

THURSDAY, FEBRUARY 11th, 1892.

REGULAR MEETING.

The President, Mr. Alexander, in the chair.

The minutes of the meetings of January 14th and 28th were read and confirmed.

Miss M. A. Buckley, John Holliday, M. A., A. King, M. A., and Wm. Wilson, were elected ordinary members of the Association.

A resolution of the Council recommending to the Association the hearty support of Mr. Beckett's scheme for a Mountain Drive, was announced and concurred in.

J. B. Turner, B.A., then read a paper entitled "The Chemistry of the Bleaching Processes," illustrating it by several experiments.

After the usual announcements the meeting adjourned.

THURSDAY, FEBRUARY 25th, 1892.

SPECIAL MEETING.

The President, Mr. Alexander, in the chair.

The Curator reported several additions to the Museum.

The President then read a paper on meteors, contributed by

H. B. Small, of Ottawa, and entitled "Messengers from the Skies." An interesting discussion followed. On motion the thanks of the Association were tendered to Mr. Small.

Mr. Beckett then outlined his plan for a drive along the face of the mountain. The following resolution, moved by F. W. Fearman, seconded by A. E. Walker, was carried:

"That this Association, after hearing Mr. Beckett's description of the proposed Mountain Drive, do approve of the scheme, and recommend its adoption by the city."

The meeting then adjourned.

THURSDAY, MARCH 10th, 1892.

REGULAR MEETING.

The President, Mr. Alexander, in the chair.

The minutes of the meetings of February 11th and 25th were read and confirmed.

The Secretary gave notice that at the meeting on the second Thursday of April he would move that certain changes be made in the Constitution. A copy of the motion was ordered to be placed in the Museum.

Mr. Bull moved, seconded by Mr. Walker, that the Secretary be instructed to communicate with the families of the late T. C. Mewburn and Charles Robertson, expressing the sympathy of the Association with them in their loss.

The receipt of twenty-six exchanges was announced.

L. Woolverton, M. A, of Grimsby, then read a paper entitled "Fungi Affecting Fruits." After the reading of the paper, a number of questions relating to diseases of fruits were asked. Reference was made to the unsatisfactory character of the present law for the inspection of diseased fruit trees. It was moved by B. E. Charlton, seconded by Thos. Littlehales, and carried, That in view of the great loss to fruit growers from the prevalence of the "Black Knot" in plums and cherries, and the "Yellows" in peaches, the Legislature of the Province of Ontario be requested to make the statute in relation to these diseases more stringent, so that the two most formidable enemies of the fruit growers of Ontario may be speedily stamped out.

The meeting then adjourned.

THURSDAY, MARCH 24th, 1892.

SPECIAL MEETING.

The President, Mr. Alexander, in the chair.

The Corresponding Secretary announced the receipt of thirty three exchanges and six Government reports.

The President referred to the proposed establishment of a Photographic Section of the Association.

C. R. McCullough then read a paper setting forth the advantages of a reformed spelling, and answering the objections most commonly urged against it. An interesting discussion followed.

After the usual announcements the meeting adjourned.

THURSDAY, APRIL 14th, 1892.

REGULAR MEETING.

The President, Mr. Alexander, in the chair.

The minutes of the meetings of March 10th and 24th were read and confirmed.

The Corresponding Secretary announced the receipt of nine exchanges and a number of Government reports.

The Curator reported some donations to the Museum made by Mrs. Charlton, to whom the thanks of the Association were expressed.

In accordance with notice given at the meeting of March 10th, the Secretary then moved that certain changes, suggested by the Council, be made in the Constitution of the Association. The motion was supported by Messrs. Walker, Forbes and Gaviller, and carried.

Twenty-eight applications for membership were received.

The President reported the progress made in fitting up the dark room for the Photographic Section, and announced that a meeting for the organization of the Section would be held in the Museum on Monday, the 18th inst., at 8 p.m.

W. H. Schofield, B. A., then read a paper on "The Jews and the Persecutions in Russia." After tracing the succession of persecutions attending the Jews in various parts of Europe, he described the measures that have been adopted against them in Russia, especially within the last eighteen months. That the persecutions are due chiefly to religious feeling, was shown, the writer held, by the

restrictions placed upon non-conforming Christians. Considerable discussion concerning the extent and cause of the present movement followed, and sympathy was expressed with the subjects of persecution.

The President directed attention to the ferns from Jamaica (the gift of Mr. Adam Brown) which were on view, and said that the remainder of the collection, together with some plants collected by Mr. Wm. Hussey in the south of England, would be ready for the next meeting.

The meeting then adjourned.

THURSDAY, APRIL 28th, 1892.

SPECIAL MEETING.

The President, Mr. Alexander, in the chair.

Five applications for membership were received.

The President then read a page by T. J. W. Burgess, M. B., F. R. S. C., of Montreal, entitled "Notes on the Genus Rhus," and dealing especially with the poisonous varieties to be found in Canada.

In the course of the discussion which followed the reading of the paper, Mr. Fearman said that in Muskoka Wild Balsam *(Impatiens Flava)* was used as a remedy for ivy poisoning.

The President announced that the next would be the annual meeting.

The meeting then adjourned.

THURSDAY, MAY 12th, 1892.

REGULAR MEETING.

The President, Mr. Alexander in the chair.

The minutes of the meetings of April 14th and 28th were read and confirmed.

The Corresponding Secretary announced the receipt of twelve exchanges and a number of Government reports.

The following, from whom applications had been received in April, were elected ordinary members of the Association: Alex. E. Adam, Jas. R. Adam, Ernest Alexander, Alf. H. Baker, J. W. Bowman, J. G. Y. Burkholder, Chas. E. Cameron, Alf. C. Crisp, Geo.

H. Cuttriss, A. L. DeVine, W. J. Grant, Geo. Lees, R. A. Mathesius, Edwin Mills, Jas. R. Moodie, Arthur Morgan, M. J. Overell, R. A. Robertson, Lucien G. Ross, Richard Southam, Robert Stark, David Sweet, Harry Sweet, J. D. Turnbull, W. R. Turnbull, W. J. Turner, Wm. White, Julius M. Williams, Jas. Gill, B. A., J. C. Hore, R. A. Hutchison, Rev. J. H. Long, M. A., and S. A. Moore.

An application for membership was received from A. D. Garrett, and on a motion of Thos. Morris, Jr., he was at once elected.

Wm. Mole, M. R. C. V. S., then read a paper, illustrated by specimens, photographs and diagrams, on the "Origin and Development of the Horse," tracing the stages of its rock-recorded evolution, and comparing its limbs with those of man. A number of questions bearing on the subject, asked by those present, were answered by Dr. Mole.

The annual meeting was then held. Reports were read as follows:

Report of the Council, by the Secretary.				
"	"	Geological Section,	by	A. T. Neill.
"	"	Biological "	"	Henry Moore.
"	"	Philological "	"	A. W. Stratton, B. A.
"	"	Physical "	"	Geo. Black.
"	"	Philosophical "	"	S. A. Morgan, B. A.
"	"	Photographic "	"	Wm. White.
"	"	Treasurer,	"	Richard Bull.

Officers for the ensuing year were elected as follows:

President, - - - - -	A. Alexander, F. S. Sc.
First Vice-President, - -	A. T. Neill.
Second Vice-President, -	S. Briggs.
Corresponding Secretary, -	Thomas Morris, Jr.
Recording Secretary, - -	C. R. McCullough.
Treasurer, - - - - -	Richard Bull.
Curator, - - - - -	Alex. Gaviller.
Ass't Secretary and Curator, -	Geo. M. Leslie.

Elected Members of Council—T. W. Reynolds, M. D., W. A. Robinson, P. L. Scriven, Wm. Turnbull and Wm. White.

After a vote of thanks to the retiring Secretary the meeting adjourned.

PRESIDENT'S ADDRESS,

At the Inaugural Meeting held November 10th, 1891.

A. ALEXANDER.

Biology—The Use of the Word—How it Came to be Used—Its Scope, and a Few of the Advantages of Biological Study.

LADIES AND GENTLEMEN:

I have to thank you for the great honor you have conferred upon me by electing me to the position of President of this Association; and while I feel that I can never fill the chair so efficiently as my predecessor, Mr. Charlton, has done for the last two years, the kindly words he has spoken in introducing me, and the intense interest I feel in the progress and work of the Association, encourage me in the hope that I may be able to help, in some feeble measure, the work to which we have set ourselves.

In looking about for a text around which I might cluster a few things I should like to say to-night, I was helped to a decision by remembering that there is an increasing number, of young people especially, who are interested in the love and study of nature. This is evidenced by the crowds that issue, in the spring and summer, from the city to the woods and fields, to look at and gather and study the flowers and insects and birds. I have been a keen observer of this daily exodus each year for at least twenty years, and I have been much gratified with the marked increase in the numbers. This, then, and the casual remark of a friend respecting the Biological Section of our Association, are responsible for the choice of the theme of my address to-night.

Since the re-organization of the Sections a few years ago, I have had occasion to speak of the Biological Section in particular, and have often urged its claims upon individual members of the Association, and asked them to attend its meetings. On more than one occasion I have been told that the word *Biological* frightened some, and that if we should call it the "Natural History" Section more would attend it.

Of course, as a matter of fact, all the members of our Association know exactly what is covered by the title "Biological Section;" they know the *derivation* of the word, and the position Biological studies occupy among the other physical sciences. Therefore in what follows I am not inferring that it is necessary to throw more light on these, but rather, that we may look historically at the various steps leading to the use of the word Biology, and how it actually grew out of the term Natural History which my friend wished substituted for Biological.

What is Biology then? The word itself came into use about ninety years ago. That is, it was first mentioned about ninety years ago, and may be said to be the expression of the growth of science during the last two centuries and a half.

At the dawn of learning, after what we call the dark ages, all knowledge was divided into two kinds. These were, the knowledge of nature, and the knowledge of man; for it seems to have been the current idea then, that there was a sort of antagonism between man and nature, in fact, that the one had not very much to do with the other, except that the one was pretty often rather troublesome to the other.

And though we find on reading the writings of some of the great thinkers of the seventeenth century, that they recognized but one scientific method, applicable both to man and to nature, we also find that some of them had a notion of the existence of a broad distinction between nature and man.

One of the writers of that period was Thomas Hobbes, whose wonderful book "Leviathan" was published in 1651. I cannot do better than quote his own terse statement in relation to the division of human knowledge at this period. He says, "The register of the knowledge of facts is called history, whereof there be two sorts, one called *Natural* History, which is the history of such facts, or effects of nature, as have no dependence on man's will; such as are the histories of metals, plants, animals, regions and the like. The other is *Civil* History, which is the history of the voluntary actions of man in the commonwealth."

So that we see, all history of fact was divided into these two groups of *natural* and *civil* history.

It will be seen from this that if our Association had existed in the time of Hobbes we should have needed only two Sections to in-

clude all we at present undertake. The Geological and Biological Sections would have met as *one* Section.

It is a very interesting fact to remember that about this time the Royal Society of England, whose monthly issue of their proceedings is regularly sent to enrich the library of this Association, was founded about the time the writer above referred to published his book. It was then called a "Society for the Improvement of Natural Knowledge," which is nearly the same thing as a "Society for the Improvement of Natural History."

Of course, as time went on, and the various branches of knowledge more distinctly developed and separated from one another, it was found that some were more susceptible of precise mathematical treatment than others.

The publication of Newton's "Principia," which I suppose gave a greater impulse to the physical sciences than any book ever published before or since, or, it might be said, any book likely to be published in the future, showed that these precise mathematical methods were applicable to those branches of science such as astronomy, and what we now call physics, which occupy a large portion of the ground of what the older writers understood by Natural History. Then chemistry was wrested from the hands of necromancers and fortune-tellers and took definite shape, which helped to lead to a distinction being made between the experimental and the observational branches (excuse the term) of Natural History.

It is evident, I think, that the term "Natural History" came to be used about the middle of the last century for those phenomena which were not at that time susceptible of mathematical or experimental treatment. That would include those phenomena which come under the general heads of physical geography (Hobbes' "regions"), geology, mineralogy, the history of plants and the history of animals.

About this time appeared several great naturalists. Among others the great Linnæus, whose work, "Systema Naturæ," is in our Public Library. The subjects these men dealt with were spoken of as Natural History, and they were called, and called themselves, naturalists. But you will notice that this was not the original meaning of the term Natural History.

I think in some of the Scotch Universities there are still, or there were at least some thirty years ago, chairs of Civil and Natural

History. Just think of such a chair as that of Natural History in the Toronto University, where the unfortunate occupant would have to travel over the whole ground of Geology, Mineralogy, Zoology, Botany and Physical Geography?

In course of time, however, it was noticed by thinking men, that under this title of Natural History there were included heterogenous constituents—that Geology and Mineralogy were very different from Botany and Zoology, and consequently that a person might obtain a somewhat extensive knowledge of the structure and functions of plants and animals without the necessity of entering upon the study of geology and mineralogy, and *vice versa*. We also find that as knowledge advanced it became evident that there was a great analogy and a very close alliance between the two sciences of Botany and Zoology which dealt with living things, while they are much more widely separated from all other branches of science. Therefore we are not surprised that at the beginning of the present century, in at least two different countries, two or three famous men clearly conceived the idea of uniting the sciences which deal with living matter into one. Lamarck, of France, as far as I can find, was the first to use the term "Biology" (from two Greek words, meaning a discourse upon life or living things.) His work was published in 1801. In the following year a German, Treviranus, published the first volume of a work called "Biologie." When completed the work extended to six volumes, on which he spent twenty years of his life. He seems to have been the only one who really worked out the idea of the oneness of all life. He contended that all those sciences which deal with living matter are essentially and fundamentally one, and ought to be treated as a whole. That is, therefore, the origin and the history of the development of the word, and that is how it came about, that all clear thinkers and lovers of consistent nomenclature came to use the term instead of the old confusing name of "Natural History," which, as we have seen, conveyed so *many* meanings, and that also is why the Hamilton Association prefer to call the section dealing with life, whether animal or vegetable, the *Biological* Section and not the *Natural History* Section.

Before we leave the subject, just a few words about the general scope of our studies in Biology. In the strict technical sense of the word it takes in all the phenomena exhibited by living things as dis-

tinguished from those that are not living. This would be all very well, so long as we confined ourselves to plants and the lower animals, but you will at once see that we should be landed in considerable difficulties when we reached the higher forms of living things.

For whatever view we may entertain about the nature of man, one thing is perfectly certain, that he is a living creature. Hence, if our definition is to be interpreted strictly, we must include man, and all his ways and works too, for that matter, under the head of Biology, in which case we should find psychology, politics and political economy, all absorbed into the province of Biology.

We should consider, for instance, our friend Mr. McIlwraith to be quite inside the Biological fence if he were to refer, as he often does, to bird calls and bird notes, or bird music, when he discourses to us about his feathered favorites—in fact, a paper from *him* on that particular subject, so very interesting, would be quite within the scope of the work of the Section under review—but, if any member were to introduce the subject of human language, or *man's music*, we should at once have the Philological Section, led by our worthy Secretary, telling us that we were on foreign soil in meddling with this subject; and no doubt Mr. Aldous would hint that in introducing such a subject as *man's music* into the Biological Section we were at least not in harmony with modern scientific usage, but would also suggest that the place for it was in the music department of the Art Section, a section as yet unrepresented in our Society.

In strict lôgic it may be hard to object, for have not the lower animals their economy and their polity?—and if, as is always admitted, the polity of bees and the commonwealth of wolves fall within the scope of the biologist proper, it surely becomes hard to say why we should not include therein human affairs, which in so many cases resemble the bees in zealous getting, and are not without a slight likeness to the proceedings of the wolves.

However, there has been a sort of practical understanding by which biologists give up to a different branch of science what Bacon or Hobbes would have called *Civil* History. This self-sacrifice can well be afforded, inasmuch as, on a moderate estimate, there are over a quarter of a million of different species of animals and plants to know all about, so that you see this section has territory more than enough for the next century or two, at least.

If we had not come together this evening to have a sort of field

night among the physical sciences, and by means of microscope, and botanical specimens, electrical and pneumatic apparatus, to come near to and hold converse with the minute and wonderful in nature, and to see the effects of some of the hidden but mighty forces of nature, I should have made a further demand upon your patience, that I might speak of what is to be gained by the study of Biology.

We generally judge of the value of human pursuits by their bearing upon human interests, that is, by their utility. Knowledge of every kind is useful in proportion as it tends to give people right ideas which are necessary as a foundation for right practice, and to remove wrong ideas which, as we all know, are the fruitful mothers of error in practice. And after all, our world seems to be largely if not absolutely governed by ideas, and very often by the wildest ideas, therefore it must be a matter of the very greatest importance that our theories of things, and even of things that may seem a great way from our daily lives, should be as far as possible true, and as far as possible removed from error. It would be in this higher and broader sense of utility that I would measure the value of the study of Biology. At many of the turns of this life of ours we feel the need of some knowledge of this science.

Those of us who had the great privilege and pleasure of hearing Prof. Ramsay Wright's lecture on Microbes do not require any argument to convince us how intimately the theory of infectious diseases is connected with biological knowledge. And surely this is of interest to all of us. This theory is being rapidly made clear by this study, and it surely behooves the general public, as well as the professional Biologist, to get a sufficient knowledge of these truths so as to be able to take an intelligent interest in the discussion of problems relating to measures for the dealing with these diseases.

I might point you to the fact that the theory of agriculture has been almost revolutionized during the last fifty or sixty years. The importance of this cannot be over-estimated, and the whole of these new views have grown out of the better explanation of certain processes which go on in plants, and which, of course, form a part of the subject matter of Biology.

I might go on multiplying examples of the many benefits, direct and indirect, derived from this branch of study, but time forbids.

And the pleasure of the study! Well, I dare not trust myself to describe it.

To make the subject complete I ought to speak of the best way of studying Biology, but I cannot now; suffice it to say, that the physical sciences can never be mastered as literary accomplishments are. They can never be mastered by merely reading books or listening to lectures on the subjects, any more than a boy could learn the business of a tea merchant by reading books about China and Japan, or India, or about tea. He has to go into a tea-merchant's office, where he can have the handling and the smelling and the tasting of the tea.

I am very much tempted here to go on and speak of our Section work in general, to tell you, among other things, that I believe the most important work done by the Association, next to the private and personal researches and field work of the individual members, is done in the Sections. I have found it so myself. I will just name one instance. At a meeting of the Biological Section held in the spring, Mr. Turner gave us a homely yet strictly scientific talk about the anatomy of birds. There we sat around the table, and he, with the skeleton and bones of his bird, made the marvellous mechanism of a bird's wing and other parts so plain to us, that I learned more in half an hour on that particular subject than I could possibly have learned from hours of reading, or from many learned lectures or papers on the subject. There the objects themselves forming the subject before us, are handed round, and the words, which are mere symbols, become real because they are linked with the object symbolized.

What I should like to see in our various sections dealing with the physical sciences is, that there should be such a true idea of the best mode of pursuing them, and such an enthusiasm in the pursuit, that out of our Association there might arise some who would pursue research into "regions beyond," for in all these fields, and, I might say, in fields that have been partially traversed, there are innumerable truths beyond the most advanced truth yet known. The why and the wherefore of most things have yet to be discovered. Let us all keep in view the objects of our Association, so that every active member may contribute something to the accumulating sum of human knowledge, and thus add to the sum of human power and happiness.

NOTES ON FOSSIL SILURIAN PLANTS, HAMILTON, ONT.

Read before the Hamilton Association, October 8th, 1891.

BY COL. C. C. GRANT.

As a general rule the fossil plants called fucoids of Silurian seas have attracted little attention. I suppose it arises from their being so seldom found even in a tolerable state of preservation. Many of them on this continent are concealed in the interior of the flags or limestone layers, and consequently are not calculated to attract attention. Accident rarely reveals the Buthotrephis of Hall in the inside of a Clinton slab. On one occasion I noted that a large projecting flag, which I was unable to reach, had at last given way through the action of frost on the underlying shales. The true Medina freestones below, as well as the "passage beds" of Dr. Spencer, had been previously quarried out and removed, leaving a perpendicular cliff on a small scale. Now it so happened that a hard block of an upper layer had lodged at the foot underneath, before its final plunge downwards. This it evidently struck edgewise. The result was the splitting of the flagstone, laying open a portion of the plant remains, or rather impressions, now contained in one of our side cases. Such a thing as this cannot often occur.

BUTHOTREPHIS, a Silurian fucoid, was named and described by the world-renowned palæontologist, Dr. Jas. Hall, of Albany, now Director General of the New York State Geological Survey, as occurring in the rocks in the United States, which are known to us Canadians now as Cambro-Silurians. The conical root, a portion of the main stem and a branch, were figured and described very accurately in an early report of the New York State Survey But I am not surprised that its claim to the title of a sea plant should be disputed at the earliest stage of its discovery, when only a short time since Dr. Nicholson, in the Palæontology of Ontario, remarked that Palæophycus Buthotrephis of Hall and Licrophycus of Billings belonged to a singular and obscure group of fossils which he indexed under the head *Incertæ Sedis*.

Perhaps in no other locality have been found more perfect specimens of Dr. Hall's Buthotrephis, than in our local Clinton rocks. From the conical root buried erect in an indurated limestone shale to the slender branch proceeding from the extremity of the main stem, it is almost as well defined as a specimen in a botanical case. The branches alternate, more robust near the base, and smaller towards the top. If only detached branches were obtained, they would probably be described and figured as distinct species, or at least varieties. It is evident that Dr. Nicholson and others have seen only mere fragments, that they have not made out where the plant bed can be found, where they were deposited *in situ*. In a layer little more than six inches thick I counted seven or eight generations, one lying above the other, with their partings of calcareous shale between.

A white colorless lingula (L. oblata) is frequently found in one of the plant beds. There are three or more; I think they are situated a little above the passage beds overlying the Grey Band of the Medina freestone. There are no indications on the surface that these Clinton flags contain fossils; an examination of the edges led to the discovery. If you carefully examine this portion you may notice short lines at regular intervals, interspersed through the matrix, differing slightly in color; note likewise that they appear to be confined to a certain part of the rock. Now if they were the burrows of *errant worms* named and figured in the Palæontology of Ontario under the name Planolites, one would expect them to present a more or less rounded shape, which they do not. I do not mean to say that Dr. Nicholson makes any mistake regarding the existence of an annelid in the muddy Clinton flats differing from other members of the family, Scolithus, Arenicolites, etc, whose burrows were vertical, not horizontal. The wisdom of this view admits of no dispute; but he adds, "The genus Planolites includes a large number of supposed *vegetable fossils* from the Palæozoic rocks which have been referred to the genera Palæophycus and Chondrites. . . . . They agree doubtless with some of the species described [as plants] by Hall and Billings from the Silurian rocks of North America." There, I think, he is quite mistaken. The error, I presume, originated, as in the former case, from his not having seen proper specimens, or from his being entirely unacquainted with their immediate surroundings.

PALÆOPHYCUS, a Silurian fucoid, was first named and described by Dr. Jas. Hall, of Albany, as occurring in the Cambro-Silurian rocks, I think, of New York, also. I first noticed it near Hamilton on the surface of a large block of Medina freestone which probably fell off a cart near the quarry and rolled down the hill. It completely covered the surface of the rock, and although a little flattened by pressure, it presented the appearance of *a soft succulent mass of sea weeds* that had been washed up on a sandy shore; some of the stems were two inches across. From a thin sandstone seam in the Grey Band I subsequently obtained a great number of specimens near the city in the old quarries below the escarpment,—perhaps young plants or varieties; they were of much smaller dimensions. Finer specimens of a Palæophycus were obtained in a freestone quarry near the Reservoir a few years ago. The most perfect one is now in the Redpath Museum, Montreal Another, too heavy to carry off, is still weathering out there, and as it is a remarkably fine one I think we ought to secure it for our collection. I feel assured if any one present had the opportunity of examining it, he would perceive in a moment the absurdity of calling such an organism a worm trail. The fucoid is ill preserved in our local Clintons and in the Niagara shale. But some years ago a cart, with a load of building stone from Lime Ridge, on the Hamilton and Caledonia road, about two miles south of the Mountain View Hotel, broke down on James street. The upper layer of Niagara limestone (glaciated) there holds many interesting species of Stromatoporæ. On examining the contents which had been dumped near the pathway, I was much surprised to find the surface of two of the largest rock masses completely covered with a Palæophycus, presenting a similar appearance to the *matted sea weeds of the Medina series*, the upper folding over the lower ones, and retaining faint traces of longitudinal striæ, even to the naked eye. Altogether, the plant from the Niagara bed was in a better state of preservation, and had attained a greater size, although clearly identical with the grey band fucoid. A middle portion of an upper stem was two and a half inches in diameter. I regret that the distinguished author of The Great Ice Age, Dr. Geikie, was apparently not aware of such a fact when he published his Class Book of Geology in 1886, and included our fucoid among trail impressions. I do not imagine he ever acquired a personal knowledge of our American Silurians,

and he seems to have placed rather too much reliance on the views of others in this and a few more instances as well.

PALÆOCHORDA.—Under this name may be classified many of the fucoids Dana notes in the Manual of Geology as occurring in the Silurians of the United States. They are rounded branching stems, he adds, from the size of a thread to that of a finger. I obtained one of the intermediate forms from the Grey Band here, which many palæontologists would suppose to be a new species. I think it may prove, if not identical, at least a variety of a cord-like form of the lower Clinton green shales. The plant in question I found at the foot of the bluff, a little beyond the Reservoir, some twenty years ago. It is in the possession of the Canadian Geological Survey. I am unable to say whether it has ever been figured or described.

The late Dr. E. Billings, in a communication acknowledging the receipt of a box of organic remains from Hamilton, noticed particularly the Clinton fucoid, which was new to him also: "The rounded, matted, conical masses, with the tubes folding over each other." I was not able to afford him at that time the additional information he required regarding its position and surroundings *in situ*; in fact, all I knew about it then was that it must have fallen from one of the overlying green bands many years previously; otherwise it could not have been weathered out so well. It was not until I had examined, long after, nearly every layer of both bands, that I at length ascertained the actual position of the fossil. It occurs at intervals in a soft muddy band in the lower green shales. Strictly speaking, it is not exactly of a shaly nature, in the general acceptance of the term. Where the plant came into contact with its immediate surroundings, it evidently possessed the property of *indurating and converting the muddy sediment into a hard, stony substance.* Arthrophycus Harlani, another seaweed, as asserted by Credner recently, is found associated with it, and also a new species of the late Mr. Billings' genus, Licrophycus. I cannot suppose any ordinary annelid ever possessed the power of changing mud into stone. Hugh Miller records an instance where some weeds and vegetable refuse had been deposited on a heap of clay; the mass in a short time, although exposed to the air, become so hard that he was forced to use a pick to remove it. I am enabled to bring to

your notice a few specimens of all three; some of them are in rather poor preservation.

Sir Wm. Dawson does not think Licrophycus represents a plant at all. He supposes it to be thè trail of a crustacean or other creature to or from its burrow. There are a few other forms, possibly organic, but for the present it may be better to put them aside as doubtful.

In the meantime we may in ascending order pursue our investigations into the Upper Red Clinton Band, which probably is the equivalent of the Iron Band of the New York State Survey. However, if limestones there rest on the Iron Band, as stated perhaps incorrectly, our upper green shales must be absent altogether, or a second ferruginous bed, which is not seen at Hamilton, caps the series. Dr. Hall, of Albany, however, informs me that such is the case. The plants of the Clinton Iron Band, widely differ from *true fucoids.* They present no internal structure like land plants, but it is rather singular that they are frequently found *erect*, and it is necessary to break the flags across, not split them, in order to get good specimens. Indeed, they seem to be species of *marsh plants* that grew on the muddy soil, and the earthy iron ore itself is perhaps due to their presence. Dana remarks that "iron could never have been deposited in *an open sea.* Clayey iron deposits do not accumulate under such circumstances; they are proof of extensive marshes, therefore of land near the level."

That the tide had access occasionally is evident from the undoubted presence of such shells as Lingula and others, which buried themselves in muddy sediment between tides, perhaps like the modern Cardium (Cockle).

A few years ago it was found necessary to remove a large quantity of stone and shale which had fallen from the cliff behind the Reservoir, near the residence of Judge Robertson. On examining the material which had been emptied down the hill slope beneath the Jolley Cut road, I was surprised to find in the debris a fragment converted into iron, resembling in external appearance a coral Zaphrentis or Clisiophyllum. Sir Wm. Dawson, however, thought it bore a nearer resemblance to a plant. I have never known a case where a coral has been changed into *iron*, but I had in my possession a land plant from the English carboniferous rocks fossilized precisely in the same manner. I have no doubt our great fossil botanist was quite correct in his views respecting it.

Although it contains few fossils the succeeding Upper Green Clinton Band is of much interest. Evidently deposited in a shallow sea, the sandstones pointing to a shore line display the ripple marks left by the waves on the Silurian beach, and the burrows of an annelid closely related to a modern lob-worm; they are vertical and in pairs. Nicholson's Planolites or errant worm occurs here also. The few plants are ill preserved; one of them had a bulbous root. While the sea bottom was undergoing depression, previous to the deposition of the limestones, a fucoid, colored black in the green shales, put in an appearance. The stems are fluted like the Cambrian Eophyton, or a striated fucoid from the lower red sandstone, figured by Hugh Miller. The branches appear to be of the same thickness throughout. When the limestone rests on the shales, the base bed of the Niagara proper, according to all Canadian geologists, it has caught up and attached, scarcely incorporated, a portion of the clay underneath. On splitting this the plant is seen, but it survived the submergence of the clay deposit, for I have traced it even in the interior of the lower building block as well as in others superimposed.

So recently as the 6th of November last, I noticed in the quarry adjoining Mr. Colbeck's place, on a limestone block, the remains or impression of a sea weed differing from others found here If I could succeed in extracting it uninjured for Sir Wm. Dawson it might prove of much interest. It is on such a massive layer that I think it may be rather difficult to do so. Dana remarks that limestones seldom contain *Plant Remains.* It is not so in Canada, however true it may be as regards the States. The limestones at Macdonald's Cove, on the north shore of Anticosti, contain detached branches, perhaps of a Buthotrephis. I obtained hundreds of specimens remarkably well preserved but never found even a fragment of the main stem or conical root. Whether they were distinct species or mere immaturities of the vegetable kingdom I was unable to determine for my part. It was in the waterlime beds at Rousseau's Creek above the Albion Mills that I discovered the beautiful fucoid represented in Sir Wm. Dawson's work on Fossil Plants as an undoubted Silurian sea plant. The layers in question hold others also, which for the present must remain undetermined. They vary considerably as regards the thickness of the stems or branches as well as in lesser particulars. I think it probable that

the specimens obtained from the bed of the stream had the carbonaceous portion removed by acidulated water flowing over them—the corneous substance of the Niagara graptolites is not always preserved. The absence of the bituminous matter in fossil plants has frequently caused them to be mistaken for *worm-casts formed by the ejecta of a marine annelid*, while, on the other hand, the roots of modern grasses penetrating between the layers of shale, stamp impressions often erroneously regarded as fossilized plant remains.

It may be thought that I am rather aggressive in my notes on some of the disputed plants of the district. That reminds me of a story I once heard at our mess. An Irish guardsman was on sentry in London. Tired of walking up and down at his post, he halted and ordered arms just as a man approached accompanied by a bull dog. The latter considered the action nothing more or less than a hostile one, and went for the soldier, who immediately brought his musket to the charge and received his adversary on the point of his bayonet. "Why did you not use the butt end and beat him off with that?" indignantly exclaimed the owner. "Sure, man, I would have done that if he came at me tail foremost, but it was the fighting end that came first and so I couldn't help it."

Further evidence on the question is given by Col. Grant in a subsequent paper in this number.

MAN SCIENTIFICALLY CONSIDERED.

Read before the Hamilton Association, January 28th, 1892.

BY J. ALSTON MOFFAT.

Man, as a subject of study, has ever been considered a profitable one for men to engage in; and although it seems to be one that he is in a position to know more about than any other, and that more correctly, yet there are few subjects upon which a greater diversity of opinion has been expressed.

The subject is unquestionably complex, with many anomalies and seeming contradictions in it, and from the limitation of the human faculty, with its inability to grasp the whole of any subject at once, and its liability to dwell almost exclusively on the side which it prefers, a partial, distorted and consequently erroneous view of it is obtained, which has often led to much profitless disputation.

Science has on this, as on many other subjects in recent years, thrown a flood of light, but so many different conclusions have been drawn from the same facts, that one is often perplexed and bewildered by his reading upon it rather than enlightened. So I thought it would be a profitable occupation for my own mind to gather together the facts so far as I could obtain them, put them in order in plain language, and see just what was known with certainty, what might be known, and what could not be known about the whole subject, and this paper is the outcome of my effort.

Now as the subject is in extent and importance out of all proportion to the time allowable for one paper, I shall have to confine myself largely to a statement of principles, leaving each one to follow out and apply them for himself.

The scientific method of investigation is to take an object just as we find it; discover as far as possible its character, constitution and origin; how it acts, and is acted upon; its relation to its environment and other organisms; its resemblances and differences; that it may be properly placed in that portion of the system of nature to which it belongs. One of the most prominent and un-

compromising principles on which scientific investigation rests, as on a foundation of adamant, is, that all the phenomena of nature, material or mental, result from the operation of fixed laws. Consequently, when we set about the investigation of any object in nature, the first step toward a right comprehension of it is a knowledge of the guiding and controlling principles or laws of its nature. For its being as it is, and its doing as it does, are the natural result of these, and the endless diversity we find in nature does not result so much from a multiplicity of laws, as from the inexpressibly diverse combinations of the materials through which they operate; for we know nothing whatever of the laws of nature except as they manifest themselves in action. Therefore, the authoritative dictum of science is, that every phenomenon in nature has an efficient cause, which utterly excludes any possibility of chance, that being merely a convenient term with which to cover our ignorance.

Causes are either immediate or with different degrees of remoteness. Each remove is as a link in a chain, each being the effect of the one preceding, and the cause of that succeeding it. We may be able to trace back quite a number of these links, whilst those more remote are wholly unknown to us. Yet science claims that there has been an unbroken continuity of these from its first origin to the present, and that there was an efficient cause for its origin; therefore it is a reasonable and desirable thing to try to discover it; hence the ever renewed and untiring efforts on the part of men to account for the origin of things.

When science takes up man as a subject of investigation, it finds him to be composed of matter, the chemical constituents of which are identical with the soil on which he treads, differing only in their combinations. He draws his sustenance more or less directly from the soil; and belonging to the animal kingdom, is subject to all the laws of animal matter, in his inception, development, maturity, decay, death and dissolution, returning again to the elements from which he came, being identical in these respects with all animal life around him. Again science finds man to be an organic being, constructed on a uniform principle; having a variety of organs, each adapted for the performance of a certain function, capable of combining and working in harmony for the good of the whole, making him a complete organization well adapted to all his requirements. But in this he does not stand alone, the organization of all

animal forms being as perfectly adapted to their requirements as man's is for his; the term 'perfect' being conditional on purpose and use.

The plan of structure in animal forms is one, modified in detail for the various functions of each. It is also one of gradations, the lower forms having few organs, and these performing functions of the simplest kind. As we rise in the scale of being, the organs are more numerous, and capable of performing a greater number of operations, until we reach man, whom science places at the head of the list, because he has the most highly developed and complex organization, capable of performing the greatest diversity of operations of any animal form on the globe. Now, the gradations rising through so many forms, the differences are necessarily slight in each, but they are not arranged on a uniform cumulative principle; that is, the one above is not always in every part in advance of the one below.

Science gathers all animated organisms into groups, each group with some distinguishing characteristic; these groups are one higher than the other, but in passing from one to the other there is often a great descent from the highest of the one to the lowest of the next above. Thus they overlap one another, and in the groups there is often great difficulty found to assign each individual its proper place, from the fact that an individual that seems to be low down in the group has something in its organization that would rightly place it much higher in the scale. This is finely illustrated in the case of the apes. These run from an exact resemblance with some of the lower Mammalia to a striking resemblance to man. Now it has been demonstrated by the strictest scientific anatomy that some of the lower forms of the apes have in their skeleton bones more distinctively human than are to be found in some of the higher ones; that the peculiarly human portion in the lower is often dropped in the one above, and another equally human taken up, no cumulative advance being made; so that, although the entire human skeleton may be found in perfection in the ape family it is not found combined in any single portion of it. And it is this combination that secures to man his rightful pre-eminence in scientific classification.

Again, science finds man to have a mental faculty. Of mind, pure and simple, science knows nothing; it obtains evidence of its

existence through the exercise of the mental organs, which are known to have their seat in the brain. Science pronounces all phenomena to be the result of matter in motion, and it defines mind to be the result of this particular kind of matter in motion, of which the brain is composed. Whether it can exist apart from matter, or manifest itself in any way except through matter, science knows not. When man is compared with the lower animals in this particular, science finds them possessed of similar faculties, manifesting themselves in similar ways, grading from mere sensitiveness up to a very high degree of intelligence, which it pronounces to be one in kind with man's differing only in degree. Indeed, in some of them, some of the faculties attain a far higher degree of development than the corresponding ones in man; but in this as in their anatomy, although all the mental faculties of man may be found scattered up and down amongst the lower animals they are not found combined in any one, so that it is impossible to say which of them is nearest to man, except in the one particular that is characteristic of them.

Science finds man to be a social being. Of this it is needless to speak, further than to say, that by means of it he attains to his highest point of excellence, and through it sinks to his lowest depths of degradation.

Science finds man endowed with powers of speech; that is, he is capable of expressing his thoughts in language that is intelligible to others. Whether he has the faculty of originating language to express his thoughts, without the aid of education, science has not yet demonstrated; but the experiments that have been made in that direction strongly favor the presumption that he has, and that children cut off from an opportunity of learning a language from others, would begin to exercise the faculty amongst themselves, and originate a language that they could understand, which might become the medium of intercourse for a nation. The lower animals have the power of communicating by sounds, with their fellows of the same kind, but these are of very limited range, and are principally connected with the preservation of their lives, and the continuance of their kind. Animals in domestication can be educated into understanding man's order given in articulate speech, but how their minds receive and act on it, we learn only through their actions, and how liable they are to be misunderstood, we know from

the oft mistaken judgments formed of the actions of our fellow men.

Again, science finds man to be a self-conscious being; that is, he is not only conscious, but he knows it; he is conscious of possessing certain faculties, and can compare them and ascertain their relative importance with one another, or with those of others, and discover whether they are greater or less than these; he reasons, and he reflects on his reasoning; he acts, or he refrains from acting, and is quite conscious that he is doing so. Yet science cannot prove the existence of this self-consciousness by any of its methods; its existence is its own demonstration, which each individual has the most convincing proof of in his own consciousness; but of its existence in others he can obtain a knowledge only by his communication with them. Human consciousness is divided into the universal and the individual, or that which has been discovered to belong to the race, and that which has been found to be restricted to individuals of it. A very slight glance around is sufficient to demonstrate that the race is not equally endowed; that although the race has all the faculties that belong to it, these are possessed in very different degrees by different individuals of it. In some a faculty may seem scarcely to exist at all, whilst in others it may be developed to such a degree that they may find themselves separated from their fellows by it, few if any being able to sympathize with them in it.

Self-consciousness is closely related to experience. Experience extends knowledge. The individual is conscious of the impression produced, and retains the knowledge obtained for his own advantage. Now, as each individual has an experience differing in some respects from all his fellows, arising from the circumstances of his life, such as the time and place in which he was born, the character of his parents, and his immediate associates, his position in the community and the advantages or disadvantages arising therefrom, his wider or narrower horizon of observation will to some extent mould his individuality and give to each a different view of life from the others, which, if communicated to them, might add much to the sum total of the profitable knowledge of the race.

Consciousness is that which gives unity to the individual life, through all the changes of time, scene and circumstances to which it may be subjected. Science can demonstrate that there is not a

single molecule composing the body at five years of age, left at the age of fifty; yet the individual can, from his own consciousness, confidently assert that he is the same person. Just how much of all this is applicable to the lower animals is mere matter of conjecture, as information on the subject is not obtainable from them by articulate speech.

Again, science finds man to be a religious being. Professor Tyndall says, "The religious principle in man is as much a verity as any part of human consciousness, and against it the waves of science break in vain." Could anything be more truly or beautifully expressed? Nothing else will account for its universality and permanence. It is coeval with the human race, and co-extensive. Observe man in any time, place or condition, and we find that this inherent principle persists in manifesting itself in one way or another. Another says, "Systems and forms of religious expression are perishable, but the religious principle itself is eternal." But many confound the two, looking only at the external expression, forgetting the principle from which it springs. Hence the oft-repeated statement that religion is merely a matter of education; which may be quite true of the form, but wholly erroneous as to the principle. That this principle can be strengthened and expanded by cultivation, or weakened and dwarfed from want of exercise, is a fact in perfect accord with every other principle in man's nature; but the one did not originate it, nor can the other utterly extinguish it.

Others again contend that religion in the world is the result of a conspiracy on the part of the priestly or ecclesiastical class, to keep men in bondage for their own personal advantage. That is like a reversing of the order of nature; the ecclesiastical class is rather the natural result of the religious principle in man. That some men have adopted the ecclesiastical profession as a means of obtaining power, preferment and wealth, is a matter of history, but they were quite innocent of originating the principle; they merely took advantage of its existence, and used it to advance their own selfish ends. Let us examine this matter a little more closely. Man, in an untutored state, is almost wholly controlled by his feelings. Now it is one of the most permanent impressions in the consciousness of the race, that man has not entire control of his own destiny, but that there is a power above and beyond himself that is capable of affecting his destiny for good or for evil; and he has a strong suspicion that he is

not in complete harmony with that power, of whose existence he is terribly conscious, but of which he knows nothing. This naturally keeps him in a state of uneasiness lest his person or possessions suffer, for it seems an instinct in the human mind, which education does not always eradicate, to erroneously regard all the unusual phenomena of nature as evidences of the pleasure or displeasure of that power, as these happen to be favorable or adverse to him. Now a man in perplexity how to act, in a matter which he is quite ignorant about, naturally seeks advice of his fellows. One, professing to be wiser than the others, recommends a course to follow; his advice is taken, and as in all cases where a person has performed what he regards as a duty, an amount of self-satisfaction naturally follows. He gets for the time a degree of relief, and concludes that the advice was good. The adviser consequently rises in his estimation as a man of wisdom, to be consulted in all times of trouble, and to be recommended to others in like cases. This gives him position and authority in the tribe. His services are found useful, then necessary, and so become permanent; and here we have the natural origin of the priestly class.

Now it is not in the power of the human mind to conceive of that of which it has no knowledge, and whenever it makes the attempt, it begins at once to form its conception of it by that which it does know; and when man tries to define that power of which he is so much in dread, he takes himself for the model as the highest being he knows of, and exaggerates upon that; and in this we get the natural origin of all the gods of all the world. For as each individual is, to some extent, diverse in character from every other, each will form his own estimate of what would be pleasing to that being of his imagination, by what would be most satisfactory to himself if he were in his place. In this we have the origin and explanation for what appears to be a standing source of bewilderment to many, the endless diversity we find in the world of the external manifestations of the internal religious principle. And when this comes to be controlled by the intelligent guidance of a a priestly class, we have the foundation laid for all the religious systems that man has ever invented to give expression to that principle within him, from the most primitive or debased to the most gorgeous and refined that the cultivated imagination and the wealth of the class can produce. Now we are in a position to see

the cause of the tremendous influence that the priestly class has ever exercised over humanity. The fulcrum is in man's nature; and, given confiding ignorance on the one hand, and designing unscrupulousness on the other, we have the explanation for much that is deplorable in human history. Now we are in a position to estimate the influence of education. Children born into any set of customs and observances follow them as a matter of course, confiding in the wisdom of their fathers for their being right. Their religious observances come to them in the same way; so as a rule, they are accepted without question, and the longer they have been established the stronger do they become, and the less likelihood there is of their being changed. Of what vast importance then it is to man that his education should be correct; for no amount of religious observance will lead him to the performance of truth, justice and mercy. He will at times violate these in following out what he considers to be duty, or will even commit what he knows to be a crime and think by a scrupulous observance of religious rites to make amends for it, and often feel quite satisfied that he has done so; all the result of a false education and his native ignorance of moral rectitude; morals being in a man almost wholly a matter of education and quite separable from religion.

Science has found no evidence of such a principle in the lower animals. This is a distinguishing characteristic of man, which places him clearly and unmistakably beyond them.

The question instantly arises, what is its import and significance? The principle is imbedded in his nature, and he can no more escape from it than he can from his shadow; and no theory of man that does not take it into account, and provide scope for its exercise, can ever be wholly satisfactory to him. We have seen that there is an ever present consciousness in the race of an unseen power in the universe that holds him in its grasp, and of which he is more or less in constant dread, and which, through all his history, has urged him on to the performance of deeds, the object of which was to propitiate it if possible; that it is in fact natural for man to believe in the existence of the supernatural. Now in the very pronouncing of that term we have parted company with natural science. For this is a region into which science can neither lead nor follow, for it is not subject to any of its methods of investigation. And yet my subject is far from being completed, and the human mind refuses

to rest in uncertainty on a matter involving such important consequences.

Science acknowledges the religious principle in man, and it ever has and ever will demand a satisfactory explanation; and if science fails us here and refuses its assistance, by the very constitution of our being we are compelled to look elsewhere for what will not.

When Darwin was pointing out to the Duke of Argyll some striking adaptations of parts to their uses, the Duke remarked that "it seemed impossible to look at them without seeing that they are the expression of mind." Darwin said: "That often comes over me with overwhelming force, but it passes away again." In that disclosure made by this eminent naturalist, we get a view of the natural operation of the human mind, in demanding an efficient cause to account for visible phenomena, which is one of the fundamental principles of modern science: that everything in nature has a cause, which, if known, would account for its existence. In this, then, I get a clue how to proceed with my subject. Leaving the scientific method, which will not here apply, I follow the scientific principle, which is of universal application, and so continue it.

You remember the expression used by Prof. Tyndall in his famous Belfast speech: "I have traced life to the utmost limits of the knowable, and looked beyond, and there was nothing." If he had said that he saw nothing, he would have been as scientifically correct as he was when he said, "of the origin of life, we know nothing." And yet science has taken many steps in advance of the position occupied by Prof. Tyndall when he used that expression, but is just as far from discovering the origin of life as ever. Now, this very subject has been under consideration for thousands of years, and many of the most powerful intellects of the race have been engaged in the effort to try to discover the cause of the visible phenomena of the universe, without a shadow of success, for, in Carlylian phraseology, "the farthing rushlight of the most brilliant human intellect will not illuminate to the depth of one-half inch that profound darkness which lies beyond."

Are we then left to the endless perplexity and vague uncertainty arising from the utter inability of the human mind to penetrate the invisible, and settle a doubt which it can neither solve nor let alone? There is an ancient document that professes to solve the mystery in

the brief but majestic statement, "And He said, let it be, and it was." Now here we are at the starting point in an endless controversy. Reject this statement, and we are agnostics on the whole subject, not from any superior wisdom or intellectual ability, not even of choice, but from very necessity; accept it, and we get an efficient and satisfactory cause to account for the most profound and perplexing mysteries that meet us in our investigations of nature. Now, it does not require a cultivated intellect to accept the word of another. It is a well-known fact, that the ignorant and uncultivated are far more likely to accept a bare statement than those that are well informed. No matter what unfair use may be made of it in argument, it is an undeniable principle of human nature; all that can be reasonably demanded is an assurance that the speaker is honest, and that he knows that whereof he speaks; and on a matter beyond his reach, the most cultivated can demand no more. If we accept this particular statement as coming from the source it claims, we cannot doubt the one or question the other; if we accept it hypothetically, then the probability of its truth has to be learned from its merits.

Now it has been laid down as an axiom in scientific discussion, that a hypothesis, to be worthy of consideration, must be in harmony with all known facts, and be able to explain difficulties more satisfactorily than any other; let us then try that statement by this test and see how it works. At once we find that it conveys to us a piece of information, that the labors of thousands of generations have made plain to us can be obtained with certainty in no other way.

In the biography of the great naturalist, whose name is used to designate a particular system of scientific philosophy, and to whose life's labors the world is so much indebted for the vast increase to its knowledge of natural subjects, as well as for the immense impulse which he gave to a more correct method of studying them, we are told that he became so impressed with the idea of man's base origin, that he would not allow himself to indulge those lofty sentiments that inspire the mind when it is brought into contact with nature in some of its grander manifestations, and to which his nature was peculiarly susceptible, as it seemed to him like a mockery for a being of such an origin to indulge in aspirations not in keeping with it, and, he thought, not likely to be realized; until by their continued suppression, he tells us that he became as a dried leaf to everything

except science, and that it was depriving him of the power to take pleasure in many of those engagements which had formerly added greatly to the joy of his life. We can all realize to some extent the tremendous loss that he sustained, in thus carrying to their natural conclusions his honest convictions. When he and the Duke of Argyll were contemplating the adaptation of parts to their uses, the natural object presented the same appearance to both, and the one was as capable of appreciating the perfection of its construction as the other; but the one accepted the above-mentioned statement as to its origin, with all that it implies, the other rejected it. This is the point of divergence between the two which leads to such opposite conclusions; for originating implies an intelligent purpose, a purpose successfully carried out; it implies wisdom and power, which again implies an interest taken by the originator in its accomplishment, that purpose being the disclosure, in some measure, of the mind and character of the originator to the intelligences of whatever grade with which the universe has been supplied, and this disclosure everything in the universe is in some way, and to some extent, actively or passively engaged in making; for everything that emanates from any mind necessarily bears the impress of that mind, and thereby in some measure discloses its character.

Now if Darwin had accepted that statement as to the origin of life, he would have been at once relieved from the depressing effects arising from the contemplation of man's animal connections; for his transient impressions would have been thereby made permanent, that intelligent mind presided over the universe, of which he was so profoundly impressed with being such an insignificant portion, as it would have convinced him that his origin was not from below, but from on high, and he could, without misgivings as to the possibility of his aspirations being realized, have thrown his mind open to every wave of joy that came in his way. Whether it was the rapturous delight in the first outburst of spring, when all nature seems to be celebrating its May-day of gladness, or under the vaulted dome of a midsummer forest, when the mind is awed as well as elevated by its grandeur, and all life seems engaged in chanting anthems of praise for the bliss of its existence, he, too, could have joined in the chorus with gratitude for eyes to see, and mind to comprehend in some measure the amazing beauty and wisdom, majesty and might, displayed in originating and guiding to bene-

ficent ends such a stupendous and complicated system of things as is here to be seen, and when all language failed to voice the depth of his emotions, he could have bowed his head in speechless adoration. Thus we see how the acceptance of that statement as to the origin of life tends to dispel the doubts and perplexities surrounding man's complex and contradictory constitution, giving full scope for the exercise of every faculty of his mind, whilst it is in perfect harmony with every principle of his nature, and has a direct tendency to elevate and improve him, thereby indicating its superiority.

Let us take an historical example of how the scientific principle leads us onward and upward where the scientific method fails to apply. Over eighteen hundred years ago a man appeared on the earth, who claimed to have, by virtue of inheritance, supernatural powers. On one ot his daily rounds, he met a man that was born blind. He spat on the ground, took the moistened dust, and put it on the blind eyes, and told their owner to wash in a particular place; the man obeyed and received his sight. Being fully conscious in himself that the means employed were wholly inadequate to produce such a result, he naturally, instinctively and unhesitatingly came to the conclusion that the man who did it must have the powers which he claimed, and there was but one source from whence such powers could be obtained. This deed being reported to the ecclesiastical rulers of the city, they set to work to investigate its truth. Having obtained all the evidence procurable on the case, they turned from the deed to the claims of the man, which they found to be antagonistic to their own, and announced that on these they could come to no conclusion; which gave occasion for the utterance of one of the most withering sarcasms ever voiced in any language. The deed they dare not deny, and it must have an efficient cause, so there was but one reasonable conclusion to come to about the claims of the doer, but that condemned themselves, and this men are slow to do. Now this man claimed to have supernatural knowledge, as well as supernatural power. He claimed that he was possessed of, and was competent to give, information on those very subjects which had harassed man during his whole history; that he knew what was beyond the visible, as he had in some sense come from there. He announced, once for all time, that there is a universe of invisible mind, as truly as there is one of visible matter; that mind can and does exist apart from matter; that there is one supreme intelligent

mind, that originated and sustains all things for a purpose; that that purpose includes the greatest possible good for all his intelligent creatures; that that greatest good consists in their knowing as much about him as it is possible for their capacities to receive, and to be as much like him in character as it is possible for them to be, as the cause of all man's perplexity has ever been his ignorance of the one and the absence of the other; and that he had come for the express purpose of enlightening him on the one, and putting him in the way of obtaining the other, which would relieve him of that conscious dread of an invisible power, that had ever followed him as closely as his shadow; that it was not necessary for him to torture himself or make great personal sacrifices in order to obtain it, not even the performance of a ceremonial, simple or elaborate, for all that he required men to do was to believe what he told them, when they would be put in possession of a conscious knowledge that it was all true, a procedure directly at variance with the scientific method.

Now we have seen that it is natural for man to believe in the existence of the supernatural; indeed, it seems to require a laborious intellectual effort for a man to succeed in reasoning himself out of the belief in it; and when any individual has honestly arrived at the conclusion that there is no conscious existence beyond the visible, it is with a wail of regret that such splendid possibilities are to be so ruthlessly extinguished. Now, as it does not require superior intellectual powers to accept the statement of another, and there are some who profess to have put this man's promise to the test, and assert that they realize in their own consciousness that it is more than fulfilled. therefore, when we find a man who stands pre-eminent in the scientific world, who is gifted with as clear an intellect as ever appeared in this or any other age, and a mind stored with facts on all subjects relating to nature to an extent seldom equalled and never excelled, and endowed with the power to express his thoughts in the most exact and clearest of language, and that in copious flow, saying, "I believe myself to be possessed of all the senses which belong to the race; and when I find spiritualists making very positive assertions of knowing about matters of which I know nothing, and which I suspect they know just as little, I cannot help suspecting that they are but visionary enthusiasts," we are not required to consider it conclusive against such claims, as if it were a subject of

natural science. The first thing we have to enquire is—has he complied with the one only condition upon which this kind of knowledge can be obtained? For we are distinctly informed that this kind of knowledge does not belong to the race; and his consciousness of its absence in himself, so clearly expressed, is a negative confirmation of its truth. Now this is a kind of knowledge that cannot be tested by any scientific methods, nor can anyone disclose it to another except by a verbal statement; so that when anyone comes to us asserting that he has it in possession, we have only his word for it. We are distinctly informed that the only evidence anyone can give to justify his right to the claim in the eyes of others, is a superior life; and by a natural and instantaneous action the human mind ever brings it to that test. Now here we are met by the objection, that in accepting this supernatural scheme of improvement and elevation for man, we are assigning to him a position and importance in the universe to which he has neither right nor claim; which is perfectly true, but the objection arises from an entire misconception of the principal design of the universe, which is not the exclusive advantage of it, or any portion of it, but as we have seen, to disclose, as much as possible, the mind and character of its designer to intelligent beings capable of appreciating it. That man has no claim to such consideration we do not require to be told, but that he is profoundly conscious of a terrible need of some such way of relief, the rivers of blood that have flowed from a myriad altars, and the smoke arising therefrom, which is traceable down through the whole course of his history, abundantly attest. But that such a scheme was originated for his exclusive benefit would be folly to suppose, even were we not positively informed to the contrary.

Now every individual of the human race is of the very first importance to himself; what he may be to the community is quite a different thing. We know that many persons obtain their importance in the world wholly from the position they occupy, and on account of it. Similar is man's position in the universe; nothing in himself but of the very first importance on account of the disclosures that are being made through him, of the mind and character of his originator. Now we know that nothing in the material universe stands apart and alone; that each and every part is in some way and to some extent dependent upon every

other; that the well-being of every living thing on this globe is affected by influences emanating from others, whilst all are adjusted to the life and fitted for the conditions of the earth; that the earth and all the planets are moving in obedience to influences beyond themselves; that our solar system is moving in sweetest harmony with other systems, to influences of which we know nothing, and these again to others still in ever extending circles, whilst the whole material universe, having a common centre, is moving to influences emanating therefrom in inconceivably majestic grandeur. As it is thus in the universe of matter, so must it be in that of mind, and as we are informed that there are minds not associated with matter, whose interests have been considered in the design of the universe just as certainly as man's, and who are engaged in increasing their knowledge of their originator by observing the events that are transpiring in the realms of matter, as well as those of mind; and as we know by man's mind that there are thoughts that language cannot express, and expressions that cannot be understood from a want of a knowledge of the subject, and that there are subjects that can be far better comprehended by a visible illustration than by any amount of verbal communication, and as one illustration may not convey the full meaning of some subjects, so some minds may fail to get the full meaning that the illustrations are designed to convey, and different minds will draw different meanings from the same illustration, whilst none obtain the full meaning disclosed by any, but each increases his knowledge of it by an interchange of thought with his fellows, thereby getting a more full, clear and correct view of it than any could get alone; and as the whole visible universe is just so many object lessons projected in time and space, for the very purpose that therein may be read, according to the capacity and diligence of the reader, the mind and character of the designer, we see not only the necessity for a vast variety of illustrations to make the disclosure, but also for a great diversity of mind to investigate them, and discover their meaning; and as mind is ever expanding by exercise and capable of understanding a subject better the more it knows about it, and as the subject is infinite, and those engaged in investigating it are finite, we see the necessity for unlimited time to continue the investigation.

Now, as everything in the universe has for its ultimate end the disclosure, as far as possible, to the intelligences thereof, of the mind

and character of their originator; and as the highest good of these consists in knowing as much about him as is possible for them to know, and thereby being made as like him in character as it is possible for them to be; for this one grand ultimate end was that amazing scheme for man's elevation, with all its tremendous consequences, originated and put in operation, which so far transcends man's most exalted powers to fully comprehend, and which is in so many respects contrary to the instincts of his nature, thereby calling forth the violent opposition of many; yet nothing else that has ever been proposed can fully meet the desperate needs, satisfy the aspirations and reconcile the contradictions of his nature at all comparably with it, thus indelibly stamping it with the imprint of its author. And although man must ever be the most directly and personally interested in the development of that scheme, so far-reaching and extended are the influences flowing from it, that the very loftiest intelligences of the universe are obtaining, by means of it, higher and yet higher conceptions of the author of their being, as the unlimited resources in the magnitude of the plan, and the wealth of beneficence in its execution are being gradually disclosed to their view, until man, the creature of the dust, and the close relation of the beasts that perish, is to them through his connection with it, an object of special interest, and this globe, so insignificant in itself amid the splendors of the celestial spheres, a centre of attraction on account of the events that are transpiring on it, by means of which they are obtaining such an insight into the character of its author as they have obtained in no other way. And as time rolls on they are ever and anon overwhelmed with new and astounding disclosures of that character, as the marvelous purposes involved in it are gradually unfolded before their wondering gaze, until all celestial language fails to give utterance to the depth of their emotions, and they are represented to us as endeavoring to find expression for them by veiled faces and prostrate forms before him, who is now to them a visible and measurably comprehensible manifestation in human form of the great invisible and incomprehensible originator of all things.

Such then is my condensation of the subject Man Scientifically Considered in so far as the language at my command has enabled me to express it.

THE CHEMICAL REACTIONS OF BLEACHING PROCESSES.

Read before the Hamilton Association, February 11th, 1892. Illustrated by Experiments.

BY J. B. TURNER, B. A.

Bleaching is the process of depriving any substance of its coloring matter and thus rendering it white and clean.

In dealing with this subject I do not propose to take up the time of the meeting in discussing the history of the processes of bleaching, neither do I propose to occupy your time by entering into a discussion of these processes and their importance from a commercial or manufacturing standpoint, though either aspect of the subject might furnish a theme for a paper as interesting or perhaps more so than the one I am about to present. I might say, however, in passing, that bleaching is a matter of first importance to the manufacturer of textile fabrics, for unless the materials of which these fabrics are to be made are thoroughly cleaned and well bleached the process of dyeing the goods will be seriously interfered with.

A few words, too, on the knowledge of the processes possessed prior to the discovery of the more modern methods will not, I trust, be out of place.

There is a strong presumption that the process of bleaching was practised by the ancient Egyptians and Phœnicians ; in that they were able to manufacture and did manufacture some very beautifully colored goods. These colors, it is almost certain, could not be obtained without first thoroughly bleaching the material of which the fabrics were composed. We have no knowledge however, as to how this bleaching was effected and consequently we are unable to state whether they used chemical reagents or exposed the material to the action of the sun and atmosphere.

The earliest methods of bleaching of which we have positive knowledge consisted in exposing the colored material to the action

of sunlight and the atmosphere. For a long time Holland was the centre of the bleaching industry, and this was the case to so great an extent that goods were sent from all parts of Europe to that country to be bleached.

The process there employed consisted in thoroughly cleaning the goods and then exposing them to the action of the atmosphere for a longer or shorter period as circumstances required. The time consumed in this process extended over from four to six and even eight months. The inconvenience of this delay was so great as to lead to the establishment of bleaching plots, as they were called, in Scotland and Ireland. The methods adopted by the managers of these plots were similar to those practised in Holland, but the time necessary for transportation from one country to the other was saved. These processes continued as the only ones in use until the discovery of the bleaching properties of chlorine, about the close of the last century. As a result of this discovery the time occupied in bleaching was very materially reduced, so that now the process of bleaching scarcely requires as many hours as it formerly did months.

The discovery of the bleaching properties of chlorine marks a decided advance in the art of bleaching; but although this is quite true, yet it was soon found that chlorine, while quite suitable for certain classes of materials, was wholly unsuitable for others on which it seemed to act in such a way as to destroy their texture and seriously impair their usefulness. In the bleaching of such materials as are injured by the action of chlorine, sulphur dioxide is now employed.

It is with these two bleaching agents, chlorine and sulphur dioxide, and the chemical reactions brought about by them, which result in bleaching that I propose to deal in this paper.

The source from which chlorine is obtained for bleaching purposes is bleaching powder, but as this is an artificial product it may be as well to give the original source of chlorine.

Chlorine, on account of its chemical activity, is never found free in nature, but in combination with some of the metals in the form of chlorides, of which the most plentiful is common salt, a compound of the metal sodium and this gas. The gas is obtained from the salt by mixing it with finely powdered manganese dioxide, and then adding sulphuric acid to the mixture. In the preparation of bleaching powder the gas thus obtained is brought in contact

with slaked lime until no more of the chlorine is absorbed by it. The bleaching powder is then stored away for future use.

When sulphur dioxide is used as the bleaching agent, the necessary supply is obtained by burning sulphur, although in the chemical laboratory it is more frequently obtained by action of sulphuric acid on metallic copper.

The bleaching powder prepared in the manner above described is the source from which chlorine for bleaching purposes is obtained. The reactions by which the chlorine is liberated from the powder may be referred to at this point. There is some difference of opinion as to the exact composition of bleaching powder, and until this is positively settled it will be difficult, if not impossible, to give correctly the reactions which result in the liberation of chlorine from it.

On the one hand it is claimed that it is a mixture of two salts, calcic chloride and calcic hypochlorite, of which the formulas are $Ca\ Cl_2$ and $Ca\ (ClO)_2$ respectively. On the other hand it is claimed that it is a single chemical compound of the formula $Ca\ Cl_2O$, which it will be observed gives the same percentage of the elements present as the mixture in the first case. The argument usually advanced in support of the latter view does not hold in the case of the powder as we ordinarily know it, and as that is the form in which it is used, it may be assumed that it is of the composition first stated. Of the salts contained in the mixture, namely, calcic chloride and calcic hypochlorite, the former is a comparatively stable salt, while the latter is very unstable, decomposing in contact with the air, by reason of the influence of the carbon dioxide contained therein, yielding among other products hypochlorous acid and free chlorine; hence the peculiar smell of bleaching powder. This also explains how it is that bleaching will take place in an aqueous solution of the powder, although very slowly, since the decomposition goes on very slowly.

The decomposition of the powder may be effected rapidly by the addition of a small quantity of sulphuric acid to the solution of the powder. For the purpose of bleaching, however, this is not to be recommended, for although the process is more quickly completed, the action of the acid injures the material of the cloth to such an extent as to overcome the advantages of rapid bleaching.

The liberation of the chlorine may be readily explained by the use of chemical equations. Simultaneously two reactions take place

between the sulphuric acid and the constituents of bleaching powder, and these reactions are represented as follows: That of sulphuric acid on calcic chioride by the equation $Ca\ Cl_2 + H_2\ SO_4 = Ca\ SO_4 + 2HCl$, and that on calcic hypochlorite by the equation $Ca\ (ClO)_2 + H_2SO_4 = Ca\ SO_4 + 2HClO$. Calcic sulphate is one of the products of each reaction, while the other product in the first case is hydrochloric acid, and in the second case is hypochlorous acid. This last material is very unstable, and is consequently readily acted upon by the hydrochloric acid, producing a result which is represented by the equation $H\,Cl + HClO = H_2O + Cl_2$; or we may represent the complete reaction by one equation, which will cover the ground of the other three, viz: $Ca\ Cl_2 + Ca\ (ClO)_2 + 2H_2SO_4 = 2Ca\ So_4 + 2H_2O + 2Cl_2$. We thus see that if the material to be bleached be immersed in an aqueous solution of the powder, or an aqueous solution which is afterwards acidulated, it will be brought in contact with the chlorine which is to effect the bleaching.

Without further experiment it is impossible to say what part the chlorine takes in the process. A few simple experiments will assist us in deciding the question. If a piece of colored calico, which has been well dried, be placed in a jar of chlorine from which the moisture has been removed by passing the gas over chloride of lime contained in tubes, and allowed to remain there for any length of time, it will be found that the color is not materially affected, but if the cloth be removed, moistened and returned to the jar, the color will in a short time disappear. Evidently then the water plays an important part in the process of bleaching by means of chlorine.

In this flask there remains material from an experiment which has been going on for several days. When the apparatus of this experiment was set up, the flask was completely filled with a solution of chlorine in water; the glass tube inserted in the cork is drawn out to a fine point, so that the liquid cannot fall out of its own weight; the whole was then exposed to sunlight for a number of days, with one evident result at least, namely, the formation of a large bubble of gas in the upper end of the flask. In this tube there is a solution of chlorine similar to that which was placed in the flask and exposed to the sunlight. Let us add a few drops of this solution to a solution of blue litmus: you observe the color is completely destroyed. In this tube there is a solution similar to that now contained in the flask; add some of it to some blue litmus solution and it becomes

red. The difference between these substances can be further emphasized by adding some of each to a solution of potassic iodide and starch paste. The chlorine water will give a deep blue coloration, while that contained in the flask will produce no change. At once it becomes evident that some change has taken place in the solution contained in this flask.

From the fact that the blue litmus becomes red we infer that the solution now contains an acid. Further experiments serve to show that the acid formed is hydrochloric acid, a compound of hydrogen and chlorine in equal proportions. An additional fact to be noted is that the chlorine, as such, has disappeared from the solution during exposure to the sunlight. How then is the hydrochloric acid formed which is found in the solution. The chlorine which enters into its composition is easily accounted for, but no mention of the hydrogen has as yet been made. The only materials which were put into the flask were water and chlorine in solution in it. The only source then from which the hydrogen could be derived is the water, of which it is one of the constituents.

By the union of the hydrogen of the water with the chlorine to form hydrochloric acid, oxygen should be set free from the water. From purely theoretical considerations, then, we infer that oxygen must be set free by this reaction, and that the bubble in the upper end of the flask must contain it; this inference will be confirmed if some of the gas of the bubble be withdrawn and tested. Putting all these facts together a satisfactory explanation of bleaching by means of chlorine is obtained.

During the actual bleaching no oxygen is allowed to escape free into the air, so that the oxygen liberated by the action of chlorine on water must be consumed in the bleaching process. In this case, as in the case of every chemical reaction where elements are liberated from their compound, they are liberated in the form of atoms, and as atoms are for the most part incapable of an independent existence, they at once unite with the atoms present for which they have the greatest affinity, so that the oxygen atoms, as they are liberated from the water, at once seize upon the atoms of the coloring matter of the goods being bleached, as being the atoms for which they have the greatest affinity. If this explanation be the correct one, then, as a matter of fact, it is not the chlorine which does the bleaching, although that is the usual way of expressing it.

The function of chlorine is rather to bring the oxygen into the proper condition in which to effect the bleaching. If then the oxygen is the substance which does the bleaching, how then is it that exposure to the atmosphere does not bleach more rapidly than it does? I shall refer to this point again in connection with bleaching by exposure to the atmosphere.

Having discussed somewhat fully the process of bleaching by chlorine, I shall deal more briefly with bleaching by the agency of sulphur dioxide.

The dioxide, as I have already pointed out, is usually obtained by the burning of sulphur when it is required for the purpose of bleaching, and, as in the case of chlorine, the material which is to be bleached requires to be moistened with water, for if it is not so moistened the material may be left in the dry gas an indefinite period without any perceptible effect on its color, but when it is moistened the color begins to disappear in a very short time.

The function of the water in this instance is not so easily discovered as in the case of chlorine. A hint as to the kind of chemical action which results in the destruction of the color by the sulphur dioxide, may be obtained if we dip a bright colored rose or other flower in a vessel of the gas for a short time until its color begins to disappear, then if the flower be removed from the sulphur dioxide and exposed to the atmosphere its color will return again. The only element present in the atmosphere so chemically active as to produce such a result is oxygen, and therefore the return of the color to the flower is the result of oxidation. There is then a strong probability that the loss of color in the sulphur dioxide is the result of a deoxidation or reduction. The question then arises, what is the material produced by the interaction of sulphur dioxide and water upon each other, and does the substance so formed act as a reducing agent? It is easily shown that the product of the action of sulphur dioxide on water is sulphurous acid. By the addition of some permanganate of potash solution to a solution of the above acid, it is readily oxidized into sulphuric acid. The same fact may be stated as a reduction of the permanganate of potash of the solution. It follows then that while neither water nor sulphur dioxide are reducing agents yet the substance formed by their union has a strong affinity for oxygen. This fact serves, in my opinion, to explain the bleaching action of sulphur dioxide. Before proceeding

with what seems to me the best explanation of this process, I shall state another view held by some good authorities, and which has the endorsation of such eminent chemists as Professors Roscoe and Schorlemmer, who, in their excellent treatise on chemistry give, on page 310, vol. 1, this statement of the explanation referred to "The decolorizing action of sulphur dioxide depends upon its oxidation in presence of water with formation of sulphuric acid, the hydrogen which is liberated uniting with the coloring-matter to form a colorless body thus :—$SO_2 + 2H_2O = H_2SO_4 + H_2$."

As I have already stated this view is that held by some chemists well qualified to speak on the subject, and I only quote from the above mentioned authors, as their treatise contains a concise statement of the explanation referred to.

I may be permitted to point out that in the absence of experimental evidence, it is difficult to believe that two substances as stable as water and sulphur dioxide are, can effect the liberation of hydrogen when they act upon each other; and further if the reaction takes place, which is represented by the above equation, what becomes of the hydrogen which is liberated if there is no coloring matter present? An experiment similar to that of the chlorine water in the sunlight ought to give us free hydrogen, but so far as I am aware such a result has never been obtained. This, I believe, is a serious, if not fatal, objection to the explanation given above.

I have, to some extent, already indicated what seems to me the correct explanation of the bleaching action of sulphur dioxide. It has been stated that water unites with sulphur dioxide to form sulphurous acid, and this acid was shown to act as a reducing agent, in that it readily deprives such a substance as permanganate of potash of its oxygen and becomes sulphuric acid. It is also well known that it is difficult to preserve sulphurous acid when exposed to the action of the atmosphere, as it is eventually oxidized into sulphuric acid when it is so exposed. This serves to still further demonstrate the fact that sulphurous acid is oxidizable into sulphuric acid and thus will act as a reducing ageut.

It is conceded by all authorities that bleaching by means of sulphur dioxide is a reducing process, and as the explanation I have ventured seems to be fully in accord with the results of the reactions between the materials present, and at the same time gives due

prominence to reduction by means of sulphurous acid, I am forced to the conclusion that the last explanation is the correct one, namely, that the water which is necessary to the bleaching process unites with the sulphur dioxide to form sulphurous acid, and this acting as a reducing agent deprives the coloring matter of its oxygen and thus destroys its color.

It may be well in closing the subject of bleaching by these two agencies to contrast their action in this respect. In the first place it was pointed out that in the case of chlorine the bleaching was the result of the oxidation of the coloring matter, while in the second case the same result is effected by reduction. It will thus be seen that the one process is exactly the reverse of the other, although the same end is attained in both cases.

In dealing with the subject I have made no reference to the cases in which the chlorine and sulphur dioxide unite with the coloring matter and thus destroy it, although such is frequently the case.

Having shown how these two agents operate in the process of bleaching, I shall refer very briefly to the action of the atmosphere as a bleaching agent. Although the bleaching effect of the atmosphere was known and taken advantage of long before either chlorine or sulphur dioxide was discovered, yet there is much less known as to how it brings about these results than in the case of either of the other two. We have shown that in the bleaching by chlorine the action of oxygen brought about the final result. If in that case the oxygen actually does the bleaching, why might not the atmospheric oxygen do the same thing? It must be remembered that in chlorine bleaching the oxygen which effects the change is that which is liberated from the water by the chlorine. Now if we remember that every element is liberated from its compounds in the form of atoms, we shall perhaps see why oxygen, just as it is liberated from water, acts differently from atmospheric oxygen. The atoms of an element, if kept free to do so, will at once unite with each other to produce molecules of the element in which form the elements for the most part exist. These molecules must necessarily be decomposed again before the element, can take part in a chemical reaction such as is necessary to effect bleaching. We thus see why it is that while nascent oxygen is capable of bleaching, it may be quite impossible for oxygen, in its ordinary form, to do so.

Since the atmospheric oxygen is in the form of molecules, it will be impossible for it to bleach any substance which is not capable of breaking up the molecule into its atoms; this, it appears, the coloring matter is not capable of doing, hence no bleaching of it is effected by atmospheric oxygen. We are thus forced to the conclusion that whatever the constituent of the air is, which causes materials to be bleached, it is not the oxygen contained in it. Nitrogen, water vapor and carbon dioxide, the other chief constituents of the atmosphere, from their very nature cannot be looked upon as bleaching agents.

Nitrogen is too chemically inactive, while water vapor and carbon dioxide are exceedingly stable, and thus will not readily lend themselves to the reactions necessary to effect the required changes.

There are a number of other materials, traces of which are present in the air, but of all these the only one which is likely to bring about the changes necessary to effect bleaching is ozone. Ozone is composed of oxygen atoms only, but since it presents properties different from those of oxygen, we must look for an explanation of this difference iu the arrangement of the atoms.

For reasons, which it is unnecessary to give here, we consider the oxygen molecule as made up of two atoms, while the ozone molecule is made up of three. Further, while the oxygen molecule is difficult to decompose, the ozone molecule is quite unstable, so that its atoms readily separate and reunite themselves in molecules of two atoms each or as ordinary oxygen. While passing from one form to the other the oxygen is momentarily in the form of atoms, as it is when it is liberated by chlorine from water, at which time it effected the bleaching usually attributed to chlorine.

It is one of the principles upon which the science of chemistry is based, that whatever a material will effect at one time it will always effect under like conditions. Since, as we have shown, nascent oxygen will bleach when liberated from water by chlorine it will also do so when liberated from ozone, by whatever agency. The ozone of the air then may be considered as a bleaching agent. The only difficulty in the way of considering it as the substance which bleaches materials exposed to the air is the fact that it is present in such minute quantities that it is almost incredible that it can do all the work usually ascribed to it.

The sun's rays are also capable of bringing about chemical

changes, as is shown by the photographic art, but as to the extent to which these enter into atmospheric bleaching I cannot at present say. I might perhaps speculate as to the part taken by the rays of light in the bleaching processes, but speculation in an experimental science, such as chemistry is, had better not be attempted. I therefore close with the suggestion that atmospheric bleaching is probably due in a measure to the action both of ozone and of the sun's rays.

MESSENGERS FROM THE SKIES.

Read before the Hamilton Association, February 25th, 1892.

BY H. B. SMALL.

There is an old Norse legend, still retained in parts of Europe, that when a child is born, the Goddess of Destiny spins a thread and hangs a star thereon, which continues to shine whilst life lasts, but at the approach of death the thread of destiny breaks, and the stars fall headlong to the earth, and is extinguished. To this legend may be traced the not uncommon remark amongst the country folk of the Mother country at the present day when they see a fallen star, that "A life is going out."

All sorts of superstitions have been attached to meteors in bygone days, and they have been regarded as omens of some great event or some dire calamity. We find in the Scriptures, associated with the calamities that were to befall Jerusalem, the expression, "The stars shall fall from heaven," and in Revelations, amidst all the fearful events described, are "The stars of heaven fell upon the earth," and "There fell a great star from heaven, burning, as it were a lamp."

In an old Latin chronicle, by Baldric, occurs the following passage, quoted in the Journal of the French Academy of Science, as adding testimony to the superstition regarding them. Baldric says, "Already, before the Council of Claremount, the stars had announced the progress of Christianity, for innumerable eyes in France saw them fall from Heaven, as thick as hail, on the 25th of April, 1095."

Ignorance is always the parent of superstition, and we have all probably read of the extreme terror the great November meteor shower of 1833 created amongst the Negroes of the South, who were convinced that it heralded the end of the world.

Virgil alluded to meteors as indicating storm, the passage translated by Dryden being as follows :—

"Oft shall thou see, 'ere brooding storms arise,
Star after star glide headlong down the skies;
And where they shot, long trails of lingering light
Sweep far behind, and gild the shades of night."

To this day we often hear it said, that the wind will blow to-morrow from a certain quarter, as the stars fall in that direction.

In some old volumes of the "Gentleman's Magazine," especially those of 1793 and 1776, are some curious notions respecting shooting stars, and quite a controversy on a gelatinous or jelly-like substance they were supposed to deposit on the grass or trees, where they fell, called by the writers "star shot" or "star jelly," and explained by Withering as "tramella nostoc."

One other anecdote of ignorance in this direction. The great November meteoric shower of 1833 was witnessed by a female servant, a new arrival from Erin, in South Carolina. Rising early to fodder cattle, she saw thousands of these meteors, till daylight stopped the display, but thought nothing remarkable of it, stating when talked to afterwards about it, that she paid no heed to it, as she thought that was perhaps the way the stars were put out every morning in this country."

The phenomenon of shooting or falling stars, or meteors, as they are more generally styled, is now acknowledged to have existed since the formation of the solar system, long anterior to the existence of man. On any clear evening, it is estimated a watchful observer may see on an average two shooting stars every five minutes, and at certain periods of the year in such abundance as to have obtained the name of "meteoric showers." These apparently emanate from a certain constellation, or from a point of space known as a "radiant" represented by some certain constellation, whilst single meteors appear to come from no particular point, but move in all directions, and from every part of the sky. These are styled "sporadic." In their normal condition these wandering bodies, before they reach our vision, are known as "meteoroids," and in their own proper orbit are never visible from the earth. They are then regular circumsolar bodies, obeying the laws of motion and gravitation as rigidly as the planets. Striking, or rather entering, our atmosphere at a speed of 48 miles per second, they at once become self-luminous from the heat engendered by friction with the tmospheric medium, and the arrested motion producing a sudden

compression of the air. To illustrate this, I may mention that there is a little instrument called an air match, consisting of a piston and cylinder, somewhat like a syringe, in which a light can be struck by suddenly forcing down the piston upon the air below in the cylinder. As the air cannot escape it is suddenly compressed, and gives out a spark sufficient to ignite a piece of tinder at the bottom of the cylinder. Some idea from this may be formed of the heat evolved by the motion of a large body in the atmosphere with the velocity of a meteor. A combustible body, under such circumstances, would be speedily ignited, but could not burn freely till reaching air of greater density; thus, on entering the lower portion of the atmosphere, it would burn with great rapidity, and, accordance to its distance, be more or less, or entirely consumed before reaching the earth. It has been estimated that by the time they have traversed a space of 50 miles, the meteoroid, or meteor, as it has then become, is heated, melted, evaporated and extinguished in a period of not less than a second of time. The height from us at which they become heated to visibility is sometimes as much as 200 miles, but the average has been put down at 75 miles, and extinction about 50 miles above the earth. The length of the arc or course they describe in their visible path varies greatly, owing to the position of the observer. One may flash up, increasing in size and brilliancy, and disappear without seemingly describing any arc. The course of such a one is directly towards the observer, but to another person 30 or more miles apart, it would exhibit an arc of several degrees in length.

Different and varied views are held by philosophers as to the origin of meteoroids. One theory is, that they are fragments of an exploded or shattered planet filling interplanetary space, most of which, through holding orbits round the sun, will ultimately fall into that body, and serve as fuel for that central orb. To illustrate this, supposing our earth, through some gigantic convulsion became disintegrated, and burst into numerous portions, these would continue to move on becoming more or less erratic in their movements; the smaller portions would first feel the influence of disturbing agencies larger than the earth, and moving inward, would become entangled, as it were, in the resisting medium in space which is now acknowledged to exist. This resistence would change their orbits, and the lighter particles would form a more erratic orbit than the

heavier or denser ones. They would gravitate towards Venus, which lies inside our orbit, and be the first to fall on it, whilst the denser fragments, metalloids and metals, would be the last.

Dr. Brewster favors the theory of meteoroids being fragments of a large planet similarly as the asteroids, the previous existence of which was long ago suggested by the vast chasm between Mars and Jupiter, where only asteroids have as yet been observed. Dr. Olbers, the discoverer of three of the known asteroids, held the same idea, and that the lesser fragments, coming within the attractive power of a planet would fall towards it, and when entering its atmosphere would go through all the conditions referred to, fusion, luminosity, etc. Sir John Herschel, however, differs from this theory. The diameter of Jupiter, the largest known body in our planetary system, is 80,000 miles, whilst that of Clio, one of the smallest, is only 16 miles. Chladin, a philosopher, at the end of the last century, thought that bodies might exist as much smaller in comparison as Clio to Jupiter, having only 16 feet diameter, and in the same ratio we come down to 1-25th of an inch, mere cosmic dust. To this cosmic dust has been attributed that peculiar fleecy brightness known as the Zodiacal light. Any observer of the western sky at this season of the year (the early spring) for about an hour after sunset, may see a soft, faint cone-shaped glow light extending about 40 degrees, following nearly the sun's path in the heavens. Near the equator, where the elliptic rises high above the horizon, it can be seen nearly all the year round, and in a very clear atmosphere in the tropics has been traced all the way across the heavens from east to west, forming a complete ring. The theory that now prevails is that the light from the sun when below our horizon reflected on the cosmical atoms of floating star-dust and meteoroids, is the cause of the soft celestial glow that now lingers evening after evening in our western sky. An illustration of this is offered by a ray of light which finds its way into a darkened room through a small orifice, revealing as motes dancing in the sunbeam the particles of dust floating in the air of the room, but visible only where the entering ray of light falls athwart them.

In this connection, the recent deep sea soundings of the "Challenger" have brought to light a curious fact. Sir Wyville Thomson found that beds of sediment were being slowly formed on the deepest ocean floors, but so slow was the rate of deposition

that it has been compared to a fall of dust in an unoccupied room. No better proof of this can be given than that an examination of the abyssal mud disclosed the presence of an appreciable proportion of meteoric iron, the product of those falling stars which dissipate themselves on entering our atmosphere. Professor Geikie says, in a recent geological lecture in Scotland:—"To learn that mud gathers there so slowly that the very star-dust forms an appreciable part of it brings home to us as hardly anything else could do, the idea of undisturbed and slow accumulation."

An interesting memoir by M. Tschermak, of the University of Wissenschaften, was published in 1875, on the source of meteoroids, and a paper on his memoir was, a few years ago, read before the Royal Irish Academy by Mr. Robert Ball. Tschermak claims a volcanic source in some celestial body. Mr. Ball follows the theory further, and by able reasoning shows that, if ejected from the planets or asteroids, there would only be a chance of one in 50,000 of them falling on the earth. In the early stage of our own earth's history, long anterior to life, when mighty convulsions were rending it, colossal volcanoes may have existed with explosive energy enough to drive missiles upwards with a velocity which would carry them far enough from the earth to a point where they would continue to move in orbits round the sun, crossing at each revolution the point of the earth's track from which they were originally discharged. If this were the case, there are now doubtless myriads of those projectiles moving through the solar system, the only common feature of whose orbit is that they all intersect the track of the earth, and, it and they now and then meeting, the point of intersection would be marked by the descent of a meteorite. This theory was hinted at by Dr. Phipson, in a work published by him in 1866, and Mr. Lawrence Smith, another later writer on the subject, inclines to the same view. No volcano now exists with explosive energy enongh to eject fragments that could constitute future meteoroids, and if such ever did exist, it could only be in the early stages of the earth's history.

Another, and an ingenious theory advanced by Professor Newton, of Yale College, and one meeting with general acceptance is, that meteoroids are fragments of or attendants on a comet, and in a lecture of his in 1879, he scientifically endeavors to prove this. Speaking of the recurring November meteoric showers which

manifest themselves at their maximum every 33 years, he says: "Vast masses of these small bodies move in a long thin stream around the sun, and the earth at stated times plunges through them, taking with its atmosphere each time scores of millions of them. Their orbit is described in 33.1-4th years. They go out a little further than the planet Uranus, or about 20 times as far as the earth is from the sun. While they all describe the same orbit they are not collected in one compact group, but taking four to five years to pass a given point in the orbit, they may be likened to a train several hundred of millions of miles long, but only a few thousands in thickness. ' Along with this train travels a comet." Every August, about the 10th of the month, there is another star sprinkle, or slighter display of meteors (known among the common people as St. Lawrence's tears), and a comet, whose period is 125 years, moves in the plane with these meteors, and in a like orbit. Again, early in December there are star showers, the meteoroids composing them travelling in the orbit of Bielas' comet. In April slight showers again occur, connected with another comet's orbit. The sporadic meteors of nightly occurrence are but outlying stragglers of a number of meteoroid streams, and the leading problem of meteor science to-day is to find these streams and their attendant comet. Professor Newton says the known comets have been apparently growing smaller with their successive returns. Halley's comet was much brighter in its earlier than in its later recurrences. Bielas' comet has divided into two, if not more parts, and has perhaps gone altogether to pieces, as it could not be found in 1872, where it should have appeared. The question naturally arises, what causes a comet to break up? This is yet only a matter of speculation, but this much is known, that comets surely come from stellar space, in whose unimaginable degree of cold a condensing mass furnished heat for the making of a meteoroid. In cooling, or by some internal convulsion, the mass may break and enter the solar system, either as a mass of pebbles or as one huge body. Nearing the sun, new and strong forces act on it. The same heat and repulsion that develop and drive off from a comet in one direction a tail 100,000,000 miles long, may have worked off and scattered in another direction solid fragments to wander in their own orbit round the sun—an infinitesimal comet for millions of years—till entering the earth's atmosphere,

one by one they crash through it either to fall on the ground or to be annihilated by friction before reaching it.

Professor Schiaparelli, an Italian authority on these questions, regards meteoroids as original inmates or portions of one of what he styles star drifts, and of whose existence decided proofs are given by Proctor, and composing with other stars of the same vast eddy attendant bodies accompanying in its journey through space the general drift or star family of which the sun forms part. On this assumption they are bodies from some more distant space than the star family of the sun, wanderers from more distant star drifts

The conflagration of a star through contact with meteoroid bodies is not an unknown occurrence. The first on record took place 2,000 years ago, and is described by Hipparchus. It was seen blazing in full daylight. A similar event is recorded in 945, in 1264 and in 1572. In 1596 Fabricius observed a similar occurrence, followed by another in 1604. In 1673 another made its appearance, remaining visible for two years, whilst as recently as 1848, a similar event was noticed, and a few years ago another appeared, which was ably written upon by Proctor in an article of his in 'Belgravia.' At the present time a burning star is apparent in the constellation Auriga, which is being watched with great interest. In 1859 two meteoric masses are recorded as having fallen into the sun and affected the whole frame of the earth. Vivid auroras were seen where they had never before been seen, accompanied by electro-magnetic disturbances all over the world. In many parts the telegraph lines refused to work, signal men received severe shocks, and at Boston and elsewhere, a flame of fire followed the pen of Baios' telegraph. This was the effect of two comparatively small meteors. What would be the effect of a comet, bearing in its flight many millions of these, falling into the sun, can hardly be understood. It would be only temporary, but no student of science would be left to record it. Proctor, however, reassures us by saying that all but one of the known star conflagrations have occurred in the zone of the Milky Way, and that one, in a region connected with the Milky Way by a stream of stars; and if among the comets in attendance on our sun there is one whose orbit intersects the sun's globe, it must already have struck it long before the era of man.

An interesting question has recently been put forward by the 'Lancet,' the well-known English medical publication, respecting

the possible influence of meteoric matter on the animal life of the earth. Professor Herschel has succeeded in examining and analyzing by means of the spectroscope, the light of seventeen of these bodies, and he has succeeded in detecting the well-known yellow bands produced by sodium in combustion. "It is strange," says the 'Lancet,' "to consider what becomes of all the sodium thus dispersed throughout the upper regions of the air, as there can be no doubt that in some form or other it reaches the earth. The very air we breathe must at all times contain, in however minute proportion, the cosmical dust thus brought to us from the interplanetary spaces, and as the different meteoric systems are differently constituted, the air we breathe is constantly being impregnated with various forms of metallic dust. It is not certain that deleterious results do not occasionally flow from an excess of some of the elements contained in meteors. Professor Roscoe goes so far as to conjecture that the soda, which all accustomed to work with the spectroscope find present everywhere, may by its antiseptic properties, exert a considerable influence in maintaining the public health." Speculations and hypotheses of this kind are no doubt interesting, but, it seems to me, barren of utility till proved, and I merely quote from the 'Lancet' to show that the study of meteors is attracting other attention than that of astronomers.

Atmospheric electricity is now also being attributed to meteoric influence, and Professor Govi, in 1878, leans to the idea that a certain amount of heat is introduced into our atmosphere by the meteors that enter it, and Professor Everett attributes the sudden variations of the needle of the electrometer from no apparent assignable external cause, to the same influence. He adds, our great want at present is balloon observations, and says that he "feels convinced that friction of the air or of the solid particles contained in it is one cause of the generation of electricity in the air."

Scientific theories necessarily lack finality. Sufficient to-day to explain all the known facts, to-morrow discoveries may show their inadequacy, and lead to their modification or abandonment.

I will now devote a few minutes to meteorites and the historical records of some of the more celebrated that have fallen from time to time, on the earth.

Amongst all people, and in almost all ages, a general tradition has prevailed of the fall of solid bodies from the sky, under various

denominations, and the meteorite has no doubt given rise to the miscalled thunderbolt.

In barbarous times, when *omne ignotum pro mirifico* prevailed, *i. e.*, when all that was unaccountable was looked on as a miracle, these missiles were ascribed to the anger of an offended Deity, and antiquarians even attribute to them the origin of the religious deference paid to the worship of stones amongst the nations of early days. The image of Diana mentioned in the Acts of the Apostles, as believed by the Ephesians to have fallen down from Jupiter, and the Palladium or sacred statue of Minerva, said to have fallen from heaven, and to have been preserved in Troy as a treasure, on the safety of which that of the city depended, had each, no doubt, this origin. It is only of late years that the attention of scientists has been given to ascertaining the origin of these falling bodies, philosophers having, up to 1802, regarded the idea of solid bodies being precipitated to the earth as entertained by the ancients, a vulgar error. In that year Mr. Howard submitted to the Royal Society a paper containing an accurate examination of testimony connected with such events, and a minute analysis of several of these substances which were said to have fallen in different parts of the globe. This excited an animated discussion, and led to a more careful study of the subject which in the last three or four years has had more light thrown on it than in all previous time, and there is now scarcely any scientific periodical which does not contain allusion more or less pointed, to meteors and meteorites.

Meteorites are divided into three groups, of which the distinguishing feature lies in the relative amounts and arrangement of the iron and stony material, or silicates, which they contain. All contain iron, almost invariably associated with nickel and cobalt. The three divisions are *aeorolites*, *aerosiderites*, and *aerosiderolites*. An *aerolite* is a meteorite composed chiefly of stony material, but containing nodules of nickeliferous iron. An *aerosiderite* is composed of solid nickeliferous iron, with little or no stony matter adhering, and an *aerosiderolite* is an intermediate variety of very rare occurrence in which the iron forming a skeleton is honey-combed in every direction by the stony portion. Meteorites are not found to contain any new elements, or rather, no elements not common to our earth are held by them; this leads to the conclusion that throughout the

universe there is unity of design in physical constitution as well as in mechanical arrangement.

By the combined rotation and revolution of the earth, that portion of it where it is sunset moves from its zenith, whilst that portion where it is sunrise moves towards its zenith, or rather towards that portion of the zodiac nearest its zenith, and thus the latter has more chance of coming in contact with isolated flying masses. Those falling at sunset must overtake the earth in its course, and thus show by their velocity that it is other force than planetary attraction which propelled them. In this connection Proctor puts forward the idea that the destruction of Sodom and Gomorrah was occasioned by a meteoric down-fall, and this ingenious theory has been followed by Mr. E. L. Garbett, a well-known architect. Tempel's comet, in whose track the November meteors travel, is shown to have passed very near the earth about the time to which tradition assigns the destruction of these cities. Supposing that the meteors, composing or accompanying this comet, broke through the air, they would, if strewn with proportionate density, fall in a compact shower on whatever part of the earth's surface happened to be most fully exposed to them. Now it is distinctly stated, "The sun was risen upon the earth before Lot entered Zoar. *Then* the Lord rained brimstone and fire out of heaven;" so that at that time the destroyed cities lay almost centrally on that disk of the earth which was turned toward the radiant of the November meteors. Thus the earth at its full speed of 1100 miles a minute, or 18 miles a second, meeting the November meteors, which travel at a speed of from 24 to 40 miles, would cause just such a catastrophe. As a still further corroboration of this, we know that the whole plain, the site of these cities, is impregnated with salt, of which sodium is the chief component, and which has, as before shown, been detected by Sir Wm. Herschel in spectroscopic analysis in the yellow bands of meteoric light.

The discomfiture of the Amorites, mentioned in the Book of Joshua, may have been from a similar cause, the account furnished being that "the Lord cast down great stones from heaven upon them."

In the Acts of the Apostles, where the town clerk of Ephesus spoke of the image which fell down from Jupiter, the word "image" is not in the original, the reading there being "that which" fell down.

Amongst the earliest records of meteorites may be mentioned one spoken of by Pliny, which fell in Thrace, 467 B. C., and was still in existence in his time. This he describes as about the size of a wagon. The Chinese records go back 644 B. C. to 333 A. D. Anaxagoras, Diogenes and Plutarch, all agreed on meteorites, and though ignorant of the comet-lore of to-day, believed they were always rotating invisible to us. A large meteoric stone is recorded at Lucania 54 B. C. In Saxony (Annales Fuldenses) a great shower of stones in 823 A. D., destroyed men and cattle, and fired 35 villages; 921, 1010, 1164 and 1304, were remarkable for them. In 1492, one fell in Alsace weighing 260 lbs., and is still shown in the church at Ensisheim. In 1501, at Padua, 1200 stones fell, one weighing 160 lbs. and another 60 lbs. In 1511 a heavy fall occurred in Crema. In 1676 a large one burst over Leghorn, and the fragments fell into the sea. In 1790 a shower of stones fell at Aden. Later records are more detailed than earlier ones, where superstitious awe seems to have retarded investigation or description. In 1803, at L'Aigle, in France, a cloud appeared, out of which, during explosions lasting five or six minutes, and described as terrific thunder, a large number of stones fell. In 1807 an aerolite of 140 lbs. fell at Smolensk, in Russia, and in 1808, in Moravia, between 200 and 300 fell. At Brandenburg and Potsdam, and in England, a deposit of dust was noticed on the water, buildings, etc., after meteoric displays in 1818 and 1822, and in 1856 the decks of a vessel 240 miles off land, in the Indian Ocean, were covered with a fall of stones the size of shot, which microscopical examination proved were of true cosmical origin, and not volcanic, as was first suspected. In 1783 a bright meteor was seen from Greenwich Observatory, and noticed all over England, the diameter of which was estimated at one mile, and its speed at 1000 miles a minute. No fragments of it were known to have been found, but after its explosion the sound took ten minutes reaching the earth.

Speaking of the sound, I have no doubt that the "thunder in a cloudless sky" spoken of in the earliest records of Latium, and deemed such an ill omen by soothsayers, must have originated from meteoric concussion.

In 1807 a large shower of meteoric stones fell at Weston, in Connecticut, of which a full account was published by Professors Silliman and Kingsley, of Yale College. In the British Museum

there are a very large number of specimens of meteoric stones, and the National Museum at Washington is not deficient in such specimens. In the Royal Academy at Stockholm are exhibited several, the largest weighing 25 tons, which were brought from Greenland by a Swedish Expedition of 1870, these being part of the "iron stones," of the existence of which the Esquimaux of Baffin's Bay had informed Captain Ross, the Arctic navigator.

To come down to recent years, in April, 1875, and May, 1879, two meteors of great size and brilliancy were observed in the Western States, illuminating the whole of Iowa, and parts of Missouri, Illinois and Wisconsin. Singularly enough both exploded over Iowa, scattering fragments of their mass over areas embracing six counties, accompanied with a noise like thunder. A full account is given in the Iowa State records, where it is stated that their chemical constitution differed from all meteorites analyzed elsewhere, these containing 7 per cent. of iron, a tenth of 1 per cent. of nickel, 17 per cent. of calcium, 47 per cent. of silica and 27 per cent. of ferrous oxide. The fragments of the meteor of 1879 fell chiefly in Emmett County, one of which, weighing 470 lbs., was sent to the British Museum, and another of 170 lbs. was sent to the State Museum of Minneapolis. At the time of its fall, some boys were herding cattle near a small lake five or six miles south-west of where the large masses fell, and they reported that just after the fireball passed over they saw and heard what seemed like a shower of hailstones falling on the water. Two large fragments of this meteor fell by the roadside, and a lawsuit was undertaken to decide whether they were the property of the finder, as wild game, or of the owner of the land, as being real estate; and it was decided in favor of the latter.

In 1878, near Covington, Indiana, a Mr. Grover, of Newton Fountain County, was killed in his bed by what was supposed to be lightning, but which further examination showed was a meteoric stone of pyramidal shape, weighing 20 lbs. This was unearthed in the cellar, some feet under the ground, traced there by the rent torn through floors and everything in its passage. The corpse was mangled as if by a cannon shot.

In 1879 near Bucyrus, Ohio, a similar death occured, the victim being a Mr. Meisenthaler, of Whitestone Township, a well-known cattle raiser of that district. As he was driving his cattle at

daylight, he was struck by a meteorite and killed. This missile is reported as having apparently come from the west, at an angle of about 60 degrees, its obliquity being ascertained by its having in its passage cut through the limbs of a tall maple tree like a cannon ball. He was struck on or under the shoulder, whence it passed through him to above the left hip, and buried itself two feet in the soft black ground. The greater part of his body was crushed into the earth beneath the stone, which was described as of a rough, round form, and resembling iron pyrites. No doubt many similar deaths have occured but are unrecorded. I could cite numerous instances, which I have in my note-books, of meteorites falling close by parties who observed them, which are authenticated as reliable.

On December 15th, 1884, at 3 a. m., a large meteor passed over Quebec, and fell on the farm of Mr. LeFrancois, near Chateau Richer, 15 miles distant, burying itself to a depth of 5 or 6 feet, and measured, when excavated, five feet in circumference.

On January 27th, 1885, a large meteor passed over the Island of Guernsey, terrifying the inhabitants. and was seen by the crew of a steamer off the island, to fall into the sea, to the west.

On September 13th, 1885, a rumbling sound awakened the residents of Akron, Ohio, at 4 a.m., caused by a large meteor passing over the place, which illuminated the country for a great distance and was supposed to have struck the ground near the eastern part of that city.

In June, 1886, a large meteor fell into Spring Pond, near St. Regis Falls, New York State, scattering mud in every direction and killing numbers of fish.

On June 12th, 1887, a large meteoric stone fell near St. Joseph, Indiana, burying itself some 12 feet in the earth, and was estimated, before it broke, to have weighed nearly two tons.

On July 1st, 1888, a large meteor was seen passing over Montreal, and was noticed also during daylight at Appleton, Wisconsin, rivalling the sun in brightness. It was visible for half a minute, but was attended with no noise.

On February 4th, 1890, a large meteor fell near Granbury, Texas, striking the peak of one of the Comanche mountains, and knocking huge boulders into the valley, barely missing in their descent Major Torres' house.

On April 15th, 1890, a brilliant meteor passed over Glencoe,

Illinois, about 10 p.m. with a loud report, and exploded a short distance east of the town. During the night the moon and stars were faintly obscured by a fine rain of ashes and minute cinders, sifting away to a light dust or gray powder.

On the same date a ball of fire passed over Levis, P. Q., at midnight, with a loud report, but no trace could be found on the ground.

On May 4th, 1890, a meteor was seen over Hancock, Kossuth, Palo Alto, Clay, Dickinson and Emmett counties, Iowa. It appeared like a large ball of fire at Angora, separating into two over that point, and then bursting into fragments, the sound of the explosion being heard three minutes afterwards. Buildings were shaken, windows broken, and a quaking of the earth was felt. A column of smoke rose, of dense appearance, as far as the eye could reach towards the zenith.

On February 24th, 1891, a large meteor passed over Portland, Maine, and was supposed to have fallen in Franklin County.

The London "Standard" of November 22nd, 1882, describing a large meteor which a few days previously passed over the northern sky, says an aurora was unusually bright at the time this strange torpedo-shaped luminous body passed majestically from east to west. It was described as resembling the glow produced by an electric current passing through a vacuum. Coincident with its appearance there was a magnetic storm of remarkable intensity. So violently were the telegraph and telephone wires deranged by the strong earth currents that their working was rendered impossible. American electricians equally experienced this interruption, and it was at the moment when the magnetic storm reached its intensity that the luminous body sailed across the sky. At Sidmouth the aurora was of an exquisite rose pink color. During the passage of the meteor the block signalling apparatus was greatly affected, two separate sections working at the same time, and the needle of the speaking instrument, instead of being read at vertical was obliged to be read at an angle of 45°. The block bells continued to ring during the passage of the object and for some seconds after its disappearance, and the signals were generally disarranged. At the same period very large spots existed on the sun's surface.

I believe the largest aerolite in any collection is in Brazil, weighing 14,000 lbs.

But time will not allow me to delay longer. I have been unable to hear of any meteoric stones existing in this section, and should be very glad to gain information of any such, if existing. It may be a new object for our Hamilton naturalists to look out for in their rambles, and of peculiar interest as leading to the study of a branch of physics only recently attracting attention.

SOME PROBLEMS IN HORTICULTURE.

I—FUNGI AFFECTING FRUITS.

Read before the Hamilton Association, March 10th, 1891.

BY L. WOOLVERTON, M. A.

How charming, to the inhabitant of the town, are the scenes of rural life; the rosy apples, the golden peaches and the various hued grapes—how attractive! His visits to the country are usually made during the summer season, during the time when the orchards are either clothed in rich abundance of pink and white blossoms, or else are laden down with their luscious fruits. The harvest time to him appears a time of joy, a time of festivity, and he thinks that, if he could exchange his life in the town for one upon the farm, he would reach the height of bliss. It is a mistaken notion to suppose that the whole round upon the farm, and especially upon the fruit farm, is but one continued round of pleasurable occupation and at the end of the year a pot of gold.

How true in this case is the old proverb "distance lends enchantment to the view."

So old Horace, the Roman poet, puts it when he describes in his first Satire, the people who are always wishing they could exchange their lots with others, fancying that any other occupation is more pleasant than their own.

> "Qui fit, Maecenas, ut nemo, quam sibi sortem
> Seu ratio dederit seu fors objecerit, illa
> Contentus vivat, laudet diversa sequentes?"

Our friends in the town know little of the hardships and discouragements which are the lot of the fruit grower, nor of the many long years spent in battling with difficulties before reaching his present prosperous condition; and it is to give the members of the Hamilton Association some idea of the difficulties which are in our way, as fruit growers, that the writer has agreed to prepare this paper.

The recent problems facing horticulturists come naturally under two heads, first, Fungus Diseases, second, Insect Enemies; and in

the brief time which you will be able to place at my disposal, I shall only have time to outline some of those which come under the first head. It is only recently that these two branches of science which refer to the very tiny subjects, such as can only be studied through the microscope, have been pursued far enough by scientists to make their investigations of real use to practical men, but now we are finding that the professor and the farmer are nearer friends than they were in days gone by. "Book larnin" was for many years despised by the latter, but now the prejudices are wearing away, owing largely to the exertions of our professors who visit the Farmers' Institutes throughout the country. A neighbor used to tell me that he could not see any use in "eddication"; he never had any "larnin hisself" and he said that he knew more than those who had. His favorite subject of conversation was astronomy, and he used to delight in meeting with us young students from the university and proving to us that all we learned at school concerning the rotundity of the earth and the distance away of the sun, moon and stars was erroneous and absurd. He could prove to a demonstration that the earth was flat and that the sun was no larger than a cart wheel and went round the "airth on'st a day." He had himself ascertained the exact distance of the sun from the earth by taking the angle, using for his mathematical instruments some chalk, a square, and ten foot boards, and proved to a demonstration that it was just five hundred miles.

Such men remind one of the redoubtable preacher spoken of by Dean Alford in his Queen's English, who used to hold forth at Cambridge, in a chapel on Green street. The Dean says his wont was to rail at the students of the University, trying to make out that it was a waste of time to study Greek and Latin. On one occasion, having wound himself up to the requisite pitch of fervor, he exclaimed in a voice of thunder, "Do ye think Powl knew Greek?"

One of the problems that was long unsolved among us fruit growers, was the cause of the PLUM KNOT, but lately mycologists have given us an insight into its life history. For a long time it was thought to be caused by some insect, and even yet we meet with men who will not give up this theory. Insects are found in it, they say, and this they claim is positive proof that they are the cause. Careful investigation, however, shows that these insects are not the cause of it, but that they simply make use of it as a favorable place

for oviposition. We have had many foolish remedies proposed and as often tried by foolish fruit growers. No less an authority than an American Consul, residing in a Canadian town, recommended, as a sure cure for plum knot, boring a hole in the trunk of the tree and filling it with flowers of sulphur. He said this would circulate through the sap of the tree and destroy the insect of the black knot. Any one cognizant with chemistry or botany will see the foolishness of such a recommendation.

The plum knot is now known to be a well defined fungus and is called by mycologists *Plowrightia Morbosa.* Little spores, corresponding with seeds, float along in the air and alight upon a suitable host, either in the form of a cherry or a plum tree. Soon the hated parasities send down their mycelial branches among the cells of the wood and derive means of nourishment. Soon they begin to throw up innumerable filaments, called conidia, on the ends of which are borne egg-shaped spores, as shown in the accompanying drawing, figure 1. These are summer spores which

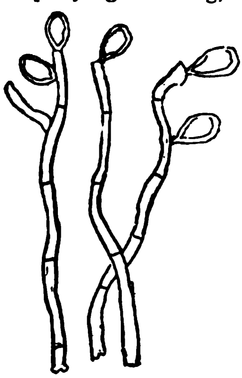


FIG. 1.—Conidiospores enlarged

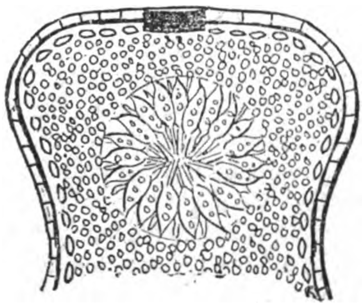


FIG. 2.—Cavity of Perithecium, with Ascospores. (May be seen in February with hand-glass.)

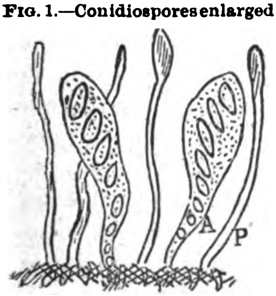


FIG 3.—Asci, containing Ascospores.

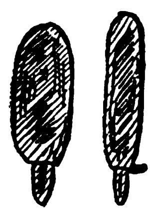


FIG. 4.—Ripe Ascospores.

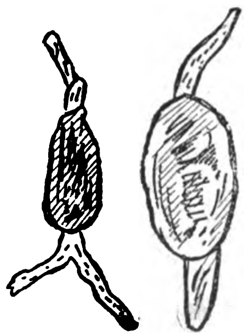


FIG. 5.—Ascospores germinating.

ripen and fall off and are carried by the wind long distances to propagate the disease.

But it is not only in the summer time that the knot is active, but also in the winter. During the month of February winter spores are formed in the little sacs called asci (fig. 3). On cutting through a knot in the month of February, these little sacs are plainly discernible with a small hand-glass (fig. 3). Each contains about eight winter spores, known to mycologists as ascospores, which one by one are carried forth to some favorable host. For a long time the cause of the plum knot was an unsolved problem, but, thanks to science, this problem has been solved, and we now know that cutting and burning the affected limbs will effectually stamp out the disease. We also know that a paste made of kerosene and paint, or turpentine, is destructive to it. But, although we have information enabling us to overcome it in our own orchards, the problem still remains, how we can compel the lazy and indolent in town and country to destroy those plum and cherry trees in their gardens which are affected. The present law seems very inoperative. True, it provides for the appointment of an inspector in every municipality, but the council is not obliged to appoint such inspector except on a petition of at least fifty ratepayers, and this is too cumbersome a mode of procedure. Further, the inspector is not required to act unless he receives written notice of the disease. All this is a mistake. He ought to be obliged to make a round of the orchards several times during the season, and have all affected trees destroyed without receiving notice from anybody.

Another problem in horticulture, which, as yet, is unsolved, is the cause of the YELLOWS in the peach. This mysterious disease originated in the peach orchards of some of the Middle States a good many years ago. It has gradually spread from state to state throughout the larger part of the Union, and across the borders into the peach orchards of our own country. Periodically its visitations seem to be more severe in character, destroying orchards by wholesale. Then, after the peach growers have given up peach growing for some time, they find themselves able to begin again with some fair hopes of success. The Department of Vegetable Pathology of the United States have taken this matter up and spent an immense amount of money in investigating into this disease, and to this work have appointed Professor Erwin Smith, who has made elaborate re-

ports of his work. But, although a large amount of money has been spent in this direction during the last three years, as yet no definite results have been obtained.

A year ago last summer I had a call from Professor Burrill, of Champaign, Ill., who was a delegate to the American Association for the Advancement of Science, then meeting in Toronto. He was looking up cases of yellows, which he said were not common in his own state. He is a man of most careful research, and his opinions are worthy of consideration. He believed that the disease was caused by bacteria, and in this most scientific men are in accord with him.

One thing we do know about the yellows, and that is that it is of an infectious character, in which respect it equals scarlet fever and small-pox. It may be carried from tree to tree, either by the bees in their searches for honey, or by instruments used in pruning the orchard.

We may hope, however, that ultimately the mystery will be solved, for the PEAR BLIGHT was, until lately, quite as mysterious. This latter has been the terror and despair of pear growers in all parts of the country. It would come in a single night upon the choicest trees in the garden and sometimes upon the whole orchard. You viewed them at night, the pride of the homestead, and, on your next visit, the foliage was blackened and sickly and the young fruit shriveled and worthless. Some said it was caused by electricity, others by sunshine, others by insects, and so on, and just as numerous were the remedies proposed; as, for instance, digging in iron filings about the tree, slitting the bark, painting the bark, etc., all of which have been tried in vain.

But now it has been shown conclusively that this terrible disease is the result of a tiny bacterium, which lives in the sap and has the power of locomotion. It is called by botanists *Micrococcus Amylovorus*, and its size, when magnified 890 diameters, is only about half the size of a pin's head and very similar in shape. Prof. J. C. Arthur, who was at that time botanist of the Geneva Experiment Station, in his report for 1887 described this bacterium and stated that it was proved to be the real and only cause of the pear blight. He discovered the organism itself in blighting tissue, and inoculated healthy tissue of other trees with the germs from that which was diseased, and, as a result, the healthy trees were at once

affected with the blight. Besides this, he found that the blight could not be communicated to healthy trees by the juices of the disease, after the germs were removed from them by filtration.

The same organism causes the twig blight of the crab apple, the quince and even, to some extent, ordinary cultivated varieties of the apple.

Prof. Burrill told me, at the time of the visit referred to, that the bacterium of the pear blight ordinarily comes through the young and succulent wood of the trees and also through the stomata of the leaves and blossoms in the early part of the growing season. This explains why pear trees, which are stimulated to make a very rapid and succulent growth, are more subject to the blight. The little bacterium, according to Mr. Burrill, has a sort of corrosive nature which enables it to pass through the cellular tissue from cell to cell, thus working along through the wood, carrying destruction in its course.

Still the pear blight is only a half solved problem. It yet remains to be shown how we may prevent its ravages and how to save the trees that are already affected. Spraying with the Bordeaux mixture early in summer, has been recommended by the U. S. Department of Agriculture as being of great value in preventing leaf blight.

One of the greatest plagues of the fruit grower is the APPLE SCAB. This has been known to botanists on the continent of Europe for some fifty years, but, since the year 1869, its habits have been more carefully observed by mycologists, who have named it *Fusicladium dendriticum.* We gave some space to its description in The Canadian Horticulturist, volume X, page 103, and since that time have endeavored to keep apple growers posted concerning the progress of the evil and the success of the various remedies proposed for its destruction. At that time it had reached Australia; now we have reports of its presence even in New Zealand.

An important step in advance was made when it was shown that the fungus causing the leaf blight of apple, which resulted in its early dropping from the tree, was identical with that known as the scab on the fruit itself.

On the leaves, the scab appears first as small olive-green spots, of a definite and rounded outline (fig. 6). These increase in size, and assume a velvety appearance, with a less regular border; some-

times two or more spots will coalesce, as it were, forming one large and irregular one. Sometimes even the petioles and the young twigs become affected; thus in every possible way the fungus tries to rob the tree of its vigor.

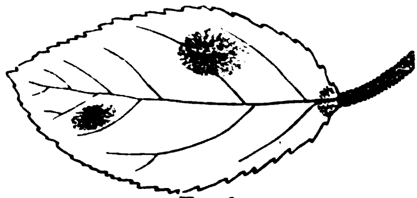


FIG. 6.

The most favorable conditions for its growth are the cool, moist weather of spring and fall, while its spread is retarded by the drouth and heat of midsummer. Owing to the dry, warm weather prevailing in the early part of last summer, our apples were much freer from scab than usual.

The fungus appears to retain its vitality during the winter season, being known to spread even in barrels from apple to apple; and it remains in a living condition through the winter on the twigs of the apples, ready to begin its work of devastation in spring-time. The loss caused to the country is alarming. The Secretary of the Illinois State Horticultural Society places the annual loss due to this parasitic growth at $400,000, but this is very small compared with the annual loss to apple growers in Ontario.

Fig. 7 shows a section of one of the leaf spots, and fig. 8 a section of the skin of an apple with scab bursting up through the epidermis, or outer skin, both magnified 200 diameters. The mycelium, or plant body of the fungus, resembles a dense mass of tissue composed of dark brown walled cells. These do not penetrate the cuticle, or

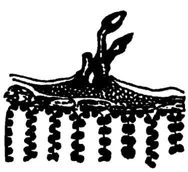


FIG 7.

FIG. 8.

inner skin, but grow between it and the epidermis, or outer skin, which they soon burst open, and send up brown threads on the ends of which are borne the spores for the propagation of the fungus.

These latter are so tiny, that it would require 3,200, side by side, to reach an inch. They germinate in moisture at a temperature

of 50° F., in about eight hours; and the germ tubes have power to penetrate healthy skin and thus quickly spread the disease.

FIG. 9.—Spores of fungus of Apple Scab. One germinating.

Prof. Scribner, in his report of 1887, recommended spraying the trees in the early spring before the buds began to expand, with sulphate of iron, 4 lbs. to 4 gals. of water; then, after fruit is set, with Bordeaux mixture. More recently, Prof. Taft and Prof. Trelease have highly commended the use of ammoniacal copper carbonate.

This spring, in the last report of the Ohio Experimental Station, we observe that Prof. Green asserts that the most satisfactory of the copper compounds for destroying apple scab, with regard to cost, convenience and effectiveness, is the dilute Bordeaux mixture. The method of preparing it is as follows:—Dissolve four pounds of copper sulphate in two gallons of hot water; add sufficient water to cool it. Slake four pounds of quick lime, add water to make a milk of lime. Pour into copper sulphate through sieve to dissolve the lime better. Dilute to fifty gallons.

One advantage of this mixture is that Paris green may be used with it, and no injury to the foliage results. The effect should be bright, clean, healthy foliage and fruit, as well as comparative freedom from curculio and codling-moth.

In the Journal of Mycology, Vol. VII., No. 1, Prof. Goff, of Madison, Wisconsin, reports his experiments in 1891 in treating apple scab. He used, chiefly, copper carbonate (1) in suspension, using one ounce to twelve gallons of water, and (2) dissolved in ammonia, one ounce to twenty-five gallons of water. In the latter case the ounce of salt was first dissolved in a quart of ammonia.

He found that the copper carbonate applied in suspension, just as we use Paris green, was nearly as effective as when half the amount was used diluted in ammonia, and it had the advantage that Paris green for codling-moth could be safely added. Treating the trees before the opening of the flowers was of great value; indeed, in one instance, where the Canada Peach apple was sprayed with copper carbonate, it was found that one application previous to the opening of the bloom was more effective than four after. On trees badly infested, the scab reduces the size of the apples so much as to lessen the crop at least twenty per cent., besides rendering a large part of it worthless.

The result of the use of the diluted Bordeaux mixture was, by Professor Green, a saving of three quarters, at least, of fruit which would otherwise have been ruined, besides increasing the size of the fruit itself, and giving it greater beauty for market purposes. In addition to this there resulted a brighter and healthier foliage upon the tree itself, which means a great deal for the vigor of the orchard. The excellent effect of spraying with this mixture is shown in the results of Professor Green's experiment at the Ohio Experiment Station with the Newton Pippin, a variety perhaps more subject to scab than any other. Of the 100 apples from the sprayed trees, 15 were first class, 74 second and 11 third, while of the same number of apples from unsprayed trees there were no first-class samples, only 40 second, and there were 60 third-class. Thus it appears that, while spraying does not wholly prevent the scab, it pays well for the outlay required of time and money.

There are other ways in which the results are beneficial besides those mentioned. The leaves of our trees, when affected by the scab, fall prematurely, carrying with them much potash and phosphoric acid, a direct loss to the strength of the tree. Now, if the leaves can be made, by spraying, to hold fast until the proper season for maturity of growth, these fertilizing constituents will be withdrawn from the leaves into the body of the tree, and there be stored up for the following year. This spraying is useful also in blight and some think in plum knot.

TOMATO ROT.—This is a fungus for which no remedy has been certainly found. It is very wide-spread in Ontario, and does great injury to the business of truck gardeners. Some varieties, as Acme

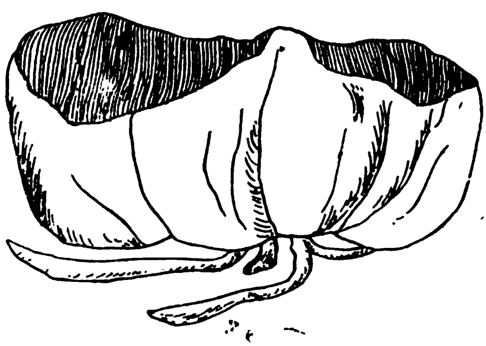


FIG. 10.

and Mikado, seem very subject to it, while Perfection, Paragon and Trophy are less so. The appearance of the affected fruit is shown in fig. 10.

By scientists it is called *Macrosporium Salani.* The fungus consists of a dark colored mycelium or vegetable system, the growing tubes of which can be readily traced to the cells of the sound tissue of the tomato, (see fig. 11*a*), and of spores, which are borne on the end of branches, called hyphæ, represented in fig. 11, *b* and *c*. These are at first dark brown, but at length turn olive-black. When these spores come in contact with green or ripe fruit, they germinate rapidly under favorable circumstances, such as heat and moisture, and send out slender tubes, shown at fig. *d.* These spores survive the winter in the shriveled fruit, and in old leaves and stems. The remedy proposed by the United States Department of Agriculture is: One-half ounce sulphuret of potassium, dissolved in a gallon of water, and sprayed upon the vines, so as to thoroughly wet all the fruit.

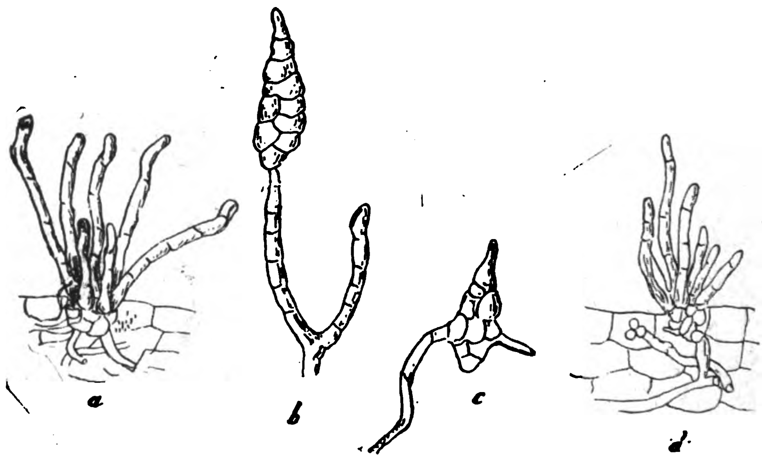


Fig. 11.

The Powdery Mildew of the Grape (*Uncinula spiralis*) is quite common in the Niagara district, and in some varieties very injurious. It appears first early in June, in the form of dull greyish white patches on the leaves and fruit. Under the microscope these patches are seen to be the mycelial growth of the mildew which spreads over the surface of the host plant, and does not penetrate its

tissue except that it sends down among the cells occasional suckers (see fig. 12, *b. b.*), by which it draws nourishment. That the threads of the mycelium are not easily distinguished is evident when we note Prof. Scribner's statement that they are each only one six-thousandth part of an inch in diameter.

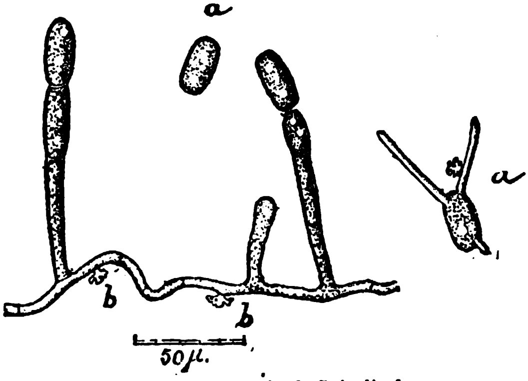


FIG. 12.—Mycelium of Uncinula Spiralis, from a grape leaf.

In June or July short upright branches appear, which are jointed, as shown in Fig. 12. One by one these terminal cells drop off. They are really summer spores for the propagation of the mildew, and are known as conidia. Two of these are shown in fig. 12, *a. a.*, which, according to Prof. Scribner, are only one-thousanth part of an inch in length at their largest diameter. These float about in the air, and alighting on a proper host soon germinate under the favoring conditions of summer heat and moisture.

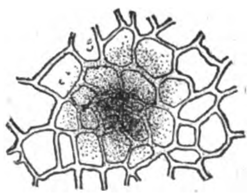


FIG. 13.

Fig. 13 shows a very small portion of epidermis of a grape berry, upon which the mycelium of Uncinula has grown, highly magnified.

Later on in the season, during the months of September and October, spores quite different in character are formed. The case in which they grow is apparent to the naked eye, and is known as the perithecium, or "fruit" of the mildew. Each of these is full of asci, three of which are shown emerging from the perithecium in fig. 14. Inside these, in turn, are the ascospores, or winter spores.

These are safely protected during the winter season by the hard compact walls of the perithecium, which in spring crack open and allow the asci to escape, and bring about a new infection of the vines. While this mildew is not nearly so destructive as that variety called the Downy mildew, still it is capable of wholly ruining the crop of certain varieties which are subject to it, as for instance, the Salem.

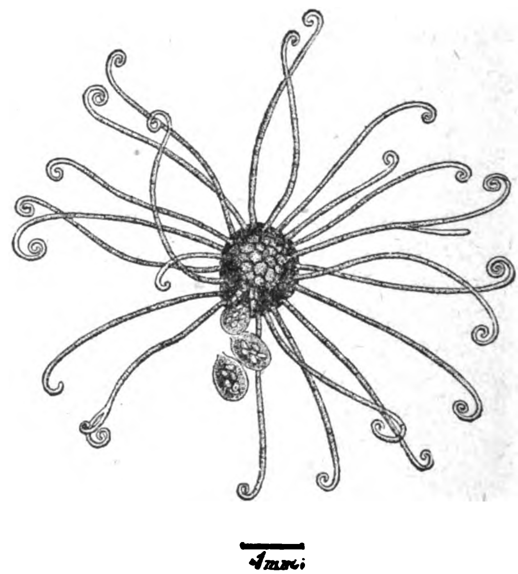


Fig. 14.—Perithecium of Uncinula Spiralis, with hooked arms, which give rise to the name *uncinula*.

The usual remedy found to be quite effectual in most cases in the Niagara district, is dusting flowers of sulphur on the vines, or, in hot weather, underneath them; but a more certain and effectual method is spraying the vines with the Bordeaux mixture, or the carbonate of copper early in the season.

The Powdery Mildew of the Gooseberry (*Sphærotheca mors uvæ.*)—Like the powdery mildew of the grape, this is a parasitic fungus, filamentous or thread-like in growth, and only attacks the surface of the host, giving it a powdery appearance. Gooseberries affected, as everyone knows, are rendered both unsightly and undesirable for food, and it is owing chiefly to the prevalence of

this mildew in Ontario that so few of the superb English varieties are found in our gardens.

It first appears on the young half grown leaves and young wood, and later upon the young berries. Prof. Scribner, in his report on Vegetable Pathology for the year 1887, gives full illustrations and description of this fungus, and to it we refer any one who wishes to carefully examine its growth. Suffice to say here, that its summer spores are formed similarly to those of the powdery mildew of the grape, the upper segments of the conidia dropping off, and being carried about easily by the wind to scatter the evil; and that its winter spores are also formed within perithecia in a similar manner to those of the grape. When these perithecia ripen they become a chestnut color, hence the gooseberry mildew in its last stage loses its white appearance and becomes a dirty brown; and in this way the condition of the mildew may be determined.

Any remedy to be successful must be early applied. Early and frequent applications of flowers of sulphur are useful, but not so effective as in the case of the grape-vine mildew. Experiments at the Geneva Experiment Station, conducted last summer, have resulted in the discovery that the most successful treatment of gooseberry mildew is with sulphuret of potassium. The bushes were sprayed at an early date with a solution of one half ounce of this substance dissolved in a gallon of hot water. It is therefore recommended as the best known remedy for this evil.

Cherry Rot (*Oidium fructigenum*) is the most serious obstacle in the way of the successful cultivation of this valuable fruit. The Heart and Bigarreau varieties, and especially the latter, are particularly subject to this fungus. The Napoleon Bigarreau, for instance, is frequently very heavily laden with fruit, but a protracted season of wet weather so encourages the development of this fungus that the rot, beginning in small spots, soon spreads from cherry to cherry, until, before picking time, the whole crop is entirely unfit for shipping. Could we succeed in overcoming this evil, we are of the opinion that the cultivation of the many very excellent varieties of cherries would be more remunerative to the grower than strawberries.

The fungus itself consists of much branched threads, or mycelia, which permeate the tissue of the fruit, causing it to turn brown and decay. When the air is moist these throw up tufts of dirty white dusty fruit stalks. These divide into minute sections

which, when ripe, separate and fall off from the top, one by one, in the form of spores. These spores are so light as to be readily carried about in the air from tree to tree, and thus the evil is rapidly spread about through the orchard. Fig. 15 is a representation of two fruiting threads of this fungus before the spores have begun to fall away, magnified 250 diameters. The engraving is reproduced from a late report of the Geneva Experiment Station.

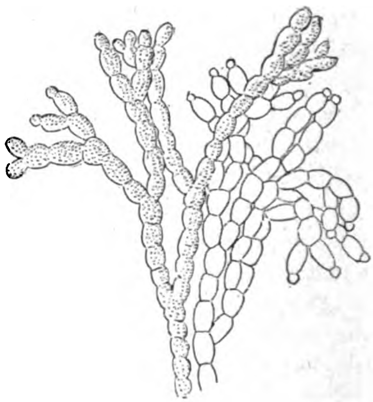


Fig. 15.

Since the spores can only develop in a moist atmosphere, it is quite evident that, if we could keep our cherries perfectly dry, there would be no rot. But, as this is impossible, we must endeavor to find some other means of preventing the evil. The spores have great vitality and preserve their generative powers from one season to another. The old ripe cherries which dry up and hang upon the trees during the winter, as well as the fallen cherries beneath the trees, are the means of carrying the fungus through to the following season. Any mode by which these could be destroyed would be helpful, whether by burning or by allowing the pigs to run in the orchard, so as to eat up all that drop. Probably the most reliable method of combatting the evil will be found in the universal remedy of spraying the trees with the Bordeaux mixture as soon as possible after the blossoms have fallen.

Plum Leaf or Shot Hole Fungus (*Septoria Cerasina*).—The leaves of cherry and plum trees are often affected by this fungus, the appearance of which is well represented in fig. 16.

The holes are frequently so round and even that they awaken considerable curiosity on the part of the observer as to their cause, but lately the mystery has been explained by Prof. Scribner, who says that they are caused by a fungus which is very widely distributed throughout the States east of the Mississippi. Though not a very serious pest, it often inflicts considerable injury both upon the cherry and the plum trees, by interfering with the proper function

of the leaves, causing them to drop prematurely, sometimes as early as the first of August. The leaves attacked show at first, scattered here and there over the surface, dark purple spots, visible on both sides, varying from one twenty-fourth to one eighth of an inch in diameter. After a brief period, the tissue covered by these spots becomes dead and brownish in color. On examining one of these brown spots under the microscope there will be detected from one to several minute black points. These are the fruits of the fungus, like little capsules, in which the spores of the fungus are produced in great abundance. These are very slender and many times longer than broad, and quite transparent. They are usually divided by one or more cross walls into two or more cells, and each cell in every spore is capable of producing a new growth of this parasitic plant.

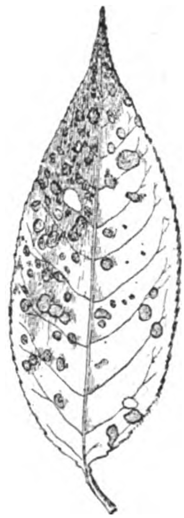


FIG. 16.

Fig. 17 represents a highly magnified section through the leaf, including one of the four capsules, and at *a*, above, are shown some of the spores, still more highly magnified. The parasite buries itself within the leaf tissue and, therefore, any treatment, to be successful, must be preventative. Spraying the trees with the copper carbonate compounds, or with the Bordeaux mixture, for preventing the plum or cherry rot will result, in all probability, in preventing the growth of this fungus.

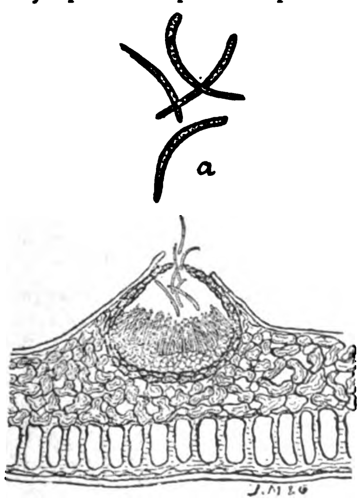


FIG 17.—Section of diseased plum leaf: *a* spores.

STRAWBERRY LEAF BLIGHT (*Sphærella Fragariæ*).—This is another of the well known difficulties which meet the grower of small fruits in Ontario. It is commonly spoken of as the "strawberry rust," "sun scald," or "spot disease," although, according to Prof.

Dudley, the term "leaf blight" would be more applicable as a common name.

This blight first appears on the new leaves about the time of the setting fruit, and if the weather of the succeeding months is dry and hot, there will result serious injury to the vitality of the

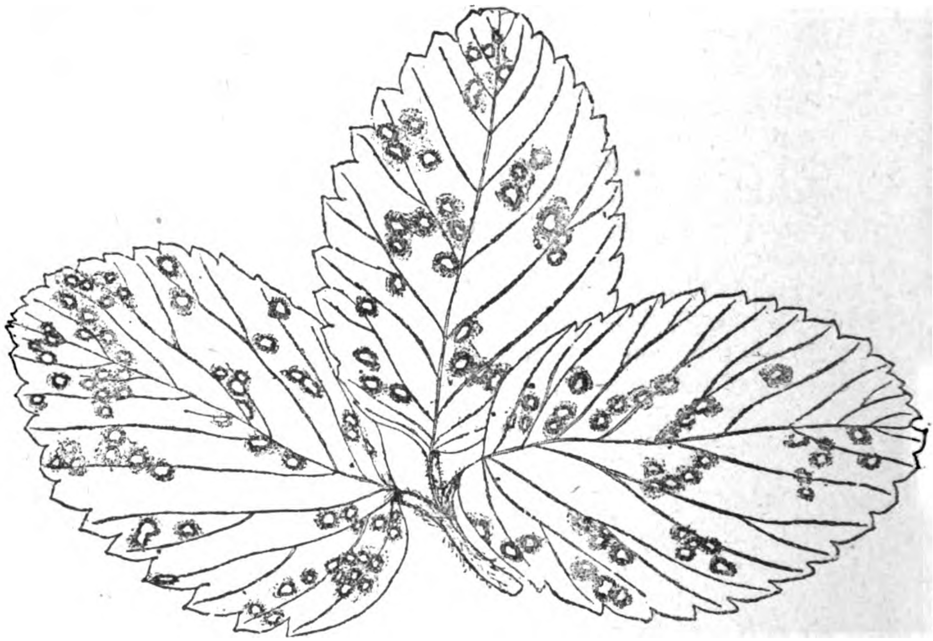


Fig. 18.

plants. You will readily recognize the common appearance of this fungus from fig. 18. The spot is at first brownish or red-purple, but when fully matured it has a circular centre dead white, from one-eighth to one-quarter of an inch in diameter. The red-purple color is the result of a growth of filaments of the vegetative portion, or mycelium, (fig. 19*a*.) of this fungus, pushing their way through between the cells of the interior of leaves, disorganizing their contents and ab-

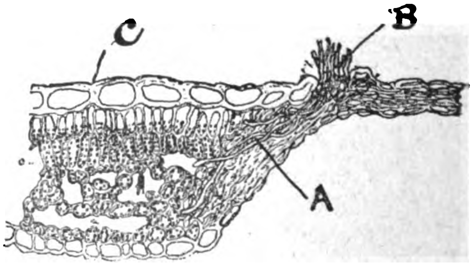


Fig. 19.—Section of diseased strawberry leaf.

sorbing their fluids. Air spaces are then formed in the centre of the spot, giving rise to the dead white appearance which results. In fig. 19 there is seen the transection of a strawberry leaf, of which the portion on the left is healthy and of the usual thickness, while that at the right shows a margin of the "spot," and this portion of the leaf is shrivelled to one-fifth its usual thickness. At *b* is seen the reproductive portion of the fungus known as conidia. The conidia-spores are oblong and very minute, and when they fall on the fresh leaf surface, where there is a moisture, soon germinate, bore their way to the epidermis *c*, and give rise to fresh spots.

In addition to this mode of propagation by conidia, which are summer spores, and short-lived, there are also winter spores grown in sacs called asci. Each ascus, or sac, contains eight ascospores, and these preserve their vitality in the dead leaves through the winter, and mature in the early spring. From this explanation it is evident that considerable benefit might be derived by strawberry growers through the plan adopted by some, of burning over the plantation in the early spring, for, in this way the fungus, to a large extent, may be destroyed.

The fungicide, recommended by Professor Scribner for spraying the strawberry bed, is three ounces of carbonate of copper dissolved in one quart of water, and then diluted with twenty gallons of water. This should be sprayed on the plantation after the crop has been gathered, and repeated once or twice before the first of September. No doubt the Bordeaux mixture would be equally effective.

Some of the varieties, as the Manchester and the Wilson, are especially liable to this disease, while other varieties, such as the Sharpless, are little troubled with it.

THE RASPBERRY ANTHRACNOSE (*Glœosporium venetum*).— This fungus is one which has thus far not prevailed to any great extent in Ontario. But from a late report of the Cornell Experiment Station, we note that it was observed in New York State last season, both on the raspberry and blackberry canes. This may yet become a serious injury to us in Ontario. An instance is given by Prof. Burrill, of a blackberry plantation in Missouri that yielded a profit of $400 one year, which was so reduced by the disease that it scarcely paid expenses the year following. The apparent injury

to blackcaps in Missouri in the year 1887 from this fungus was estimated at from ten to twelve per cent. of the entire crop.

·FIG. 20.—Raspberry Anthracnose.

It first appears in the form of small purple spots scattered around the lower parts of the canes. These soon rapidly increase in size and spread from the lower portion of the canes upward, giving them a scabby, pithy appearance, as shown in fig. 20. The damage done by these blotches rarely extends to the pith, but the greatest injury is done to the cambium layer, or the portion through which the sap is conveyed in the process of growth, resulting very much the same as if the cane had been girdled. As a result, the leaves do not attain more than half the normal size, and the fruit, if developed at all, does not reach its full development, but ripens prematurely, or simply dries up and is worthless. If the canes are not killed the first year, the continued action of the fungus on the leaves and branches prevents the formation of fruit the succeeding year. After the fungus has appeared upon the canes, the petioles of the leaves are attacked in the form of purplish spots near their base. Gradually the disease spreads throughout the whole framework of the leaves, showing white blister-like spots.

We omit any description of the botanical character of this fungus, but simply remark that in overcoming it, a vigorous condition of the plant is important, and any old plantations which are diseased would be better cleared out and burned. One experiment station

recommends spraying early in the spring, before the growth has begun, with sulphate of iron, a pound to a gallon of water, and after the leaves appear, with the Bordeaux mixture.

For many of the illustrations used with this paper, and for much information, I am indebted to the excellent publications of the Department of Agriculture, Section of Mycology, of the United States. In this important field of study a great advance has been made during the last few years, and the results are proving to be of immense value to fruit growers and gardeners. Many of the worst problems facing the horticulturist have been satisfactorily solved, and many others will be cleared up during the coming year. The importance of a widespread dissemination of the work of these experimenters, in its relation to the prosperity of our province, can scarcely be over-estimated.

THE SPELLING REFORM.

Read before the Hamilton Association, March 24th, 1892.

BY C. R. M'CULLOUGH.

"As the instrument of all thought, the medium of all science, language is not only essential to civilization, but its basis. Deprived of a system of intercommunication the progress of mankind would be impossible."

The history of language is the history of civilization. The discovery of a method of symbolizing thought, the invention of an alphabet, the adaptation of independent types, mark the three greatest eras of human progress.

The first writing known to man was undoubtedly hieroglyphic. These hieroglyphs were simply pictures of thought, each picture being illustative of an idea. This system was therefore adapted to a period when ideas were comparatively few, or to a civilization at stand-still. With the increase of ideas came the demand for some more ready means of recording thought, and as necessity has ever been the mother of invention, the idea was conceived of transferring the symbol or picture from the thought to the sound employed in speech to represent that thought.

The Egyptian priests were acquainted with both the hieroglyphic and the alphabetic systems, and kept their secrets of caste and creed by the former on account of the greater difficulty attending its acquisition and retention in the memory. The hieroglyph lives to-day in the Chinese method of language representation, and the contrast between the intellectual standing of the people of that empire, and the rest of the world—the progress in civilization and science of Europe and America, in contrast with the stationary intellect and political status of China—is strong testimony to the relative merits of the two methods for furthering the ends of civilization and advancement.

There were defects in the Latin alphabet which were transmitted from one age and nation to another. As a result modern English in its representation is less true to the alphabetic theory on which it professes to be based than was the case hundreds of years

ago, and, owing to the constant change in pronunciation, which is being followed by no corresponding alteration in the spelling, we are being rapidly carried back to the hieroglyphic type of thought representation. The matter should, then, command the profound interest of the progressionist, and challenge the attention and win the efforts of all who have at heart the advancement of the race.

English spelling is not acquired by sound—no, the teacher who should instruct his pupils to proceed on this theory of spelling words would meet with very unsatisfactory results. Learners are, on the other hand, instructed to familiarize themselves with the appearance of words, and to carry them in the eye as they would a picture, a face or a figure—in short, to take the word as a whole, just as the Egyptians of old were compelled to carry their hieroglyphs. The result of this is to render more difficult the acquisition of an elementary education, and were it not for the pluck, perseverance and pertinacity of the race, coupled with improvements in educational methods, English-speaking people would in due time realize the fact that other nations were leading them in learning and advancement.

The spelling-reformer, no less than the reformer in any other department of life and effort, is always exposed to criticism, occasionally to censure, and not infrequently to ridicule. If, however, the reformer is able to maintain his position and prove the truth of his contention, we should, I think, acknowledge the fact and shake off that inertia which is more deadly to the success of any movement than the most uncompromising opposition.

The movement for reformed spelling is not the creation of this pre-eminently creative age. As early as the thirteenth century Ormeen had raised his voice in its behalf. In the sixteenth John Hart and Sir Thomas Smith (Secretary of State under Edward VI), urged reform. These advocates of improvement in language representation were followed by Sir John Cheke, and in the seventeenth Bishop Wilkins appeared with his "Philosophical Language." In the eighteenth Dean Swift, Benjamin Franklin, James Elphinstone and others took up the cause, and during the present century we find a Webster so far convinced of the necessity for reform as to introduce into his dictionary such spellings as "labor," "center," "traveler," "worshiper," etc. So general has been the acceptance of these spellings that throughout the continent of America, and, indeed, to some extent in England, they are the received forms of the words.

When to such a list of famous men as the foregoing we are enabled to add the names of the most eminent philologists and etymologists of our own times, Muller, Sayce, Dr. Murray, Whitney, Skeat, Dr. Ellis, Sweet, March, and such noted men as Tennyson, Darwin, Spencer and Isaac Pitman, I feel that no apologies are necessary in choosing this as a fit subject on which to address the Hamilton Association.

For one hundred years previous to the Norman conquest there had been a fixed spelling in England, almost as much so as ours after four hundred years of the printing press. The author of the Ormulum (1215), prayed that in transcripts from his work respect might be had for his orthography; and the "Father of English Verse" begged that no one should alter the spelling of his little book "Troilus and Cressida." English spelling has, however, seen many changes since the time Chaucer expressed his wish, and it may be added that the changes, especially since the fifteenth century, have not all been for the better. Owing to the conservatism exercised by the press our orthography may be considered as fixed, but a little research will show that not a few changes have taken place within the past century. I have in my possession volume I. of the "Spectator," edition of 1797, in which I noted the following spellings: Aukward, ribband, teint (taint), sculked, irreconcileable, bredes (braids), bason, bull-rush, thorough-base, dropt, smoak, befal, ile (aisle), story'd, cloysters, ribbaldry, inchanted, motely, negociations, malecontents, flead (flayed), cearments, expence, choaked, alledge, corps (corpse), stopt, janty, phraise, controul, merchandize.

English spelling, however, has not kept pace with English pronunciation, which is ever on the move; and owing to the conserving influence of the press the distance between them is rapidly increasing. True it is that in a few instances changes in speech have been accompanied by changed spellings, but the fact remains that the eye is being educated at the almost total expense of the ear. Voltaire said: "Writing is the painting of the voice. The nearer it resembles it the better." The definition given by Dr. Hayward before the Liverpool Literary and Scientific Society is worth repeating: "Language is what is spoken, not what is written; writing is merely an endeavor to convey language to the eye, as speaking is an endeavor to convey it to the ear."

In the thirteenth and fourteenth centuries the English language

was respelt after the Anglo-French method, becoming French rather than English in its orthography. Before the latter part of the fifteenth, spelling was practically phonetic, but the revival of classical learning in the sixteenth interfered with this principle, and many words connected with Greek and Latin were altered to conform with the spelling of those languages. At this time was born that absurdity known as "etymological" spelling; an endeavor to render the etymology of words evident to the eye and not to the ear. Spelling after this fashion was proceeding on a false principle which almost wholly ignored the scheme of alphabetic writing. It is needless to point out the many errors in the derivation of words occasioned by the attempts of the pedants of this age. Interested students are advised to refer to Skeat's "Principles of English Etymology," chapter XVI, for information on this point. The same eminent philologist directs particular attention to the phonetic character of Anglo-Saxon, and urges it as a very strong reason why a return should be made to the principle of spelling observed by our ancestors. It appears to me that if the generality of people were aware of the fact that centuries ago spelling appealed to the ear, and not to the eye only, there would not be that opposition to reformed spelling so often met with.

It has been carefully ascertained that not more than one word in a thousand is now spelt as pronounced. This is sufficient evidence to show that we have almost completely lost the central idea of alphabetic writing. It is unanimously agreed by philologists that the invention of letters was the invention of phonetic writing. The scheme of spelling by sound was followed as far as the few symbols would permit or the needs of the writer demanded. As language grew and expanded, difficulties arose which, however owing to the veneration in which the invention of the alphabet was held, were not adequately met by the addition of new letters. The trouble was in a measure overcome by employing the old symbols within certain limits, and in later times by the use of diacritics.

If we examine Sanskrit we shall find the strongest proof that the phonetic principle characterized the earliest alphabets. Changes in speech were marked by corresponding changes in the spelling, and yet it is worthy of notice that in no language can the etymological and grammatical relationship of words be more clearly shown or more easily traced than in Sanskrit.

The alphabet introduced into England was insufficient to represent the many sounds heard in Anglo-Saxon, and was constructed to represent not English but Latin. This system was, however, adopted its deficiencies being in some degree made up by employing digraphs and resorting to other expedients. Two of the runes were retained because there were no Roman letters to take their places. They were "þ," afterwards represented by "th," and "ƿ," superseded by "w," this being formed by the union of two "v" characters (vv). (This "v" had the power of "u" in "rune.")

As the language expanded, the evil became intolerable, and the awkwardness of employing one letter to represent two sounds, led to the introduction of a separate sign for the vowel sound "u," and assigning the "v" to the consonantal sound. "V," as a sign proper for the consonant as distinct from the vowel, was not established in its place until the seventeenth century, although as a spoken sound it had been in use since the conquest. Before the introduction of the written "v," the rule prevailed that "u," when doing duty as a consonant, should be used between two vowels, as in "euil," "liue." The latter of these vowels being generally an "e," it followed that words ending in the "v" sound were written with a final "e." When the "v" came in as the representative of the consonantal sound, it might have been expected that the final "e" in words that had formerly been written "haue," "giue," "serue," would be dropped, and these words written "hav," "giv," "serv," etc., but a stupid conservatism has persisted in retaining the useless terminal "e." "J" was invented during the fifteenth century, its origin being the prolongation of the "i," but did not come into general use until the seventeenth century. In the earliest printed books "i" and "y," as well as "v" and "u," were used in a very arbitrary manner. Caxton spells, "unyversal," "fyrst," "Iulyus," "Byble," "wryte," etc. In Tyndale's New Testament we find "vnto," "seruaunt," "greuously," "vnder," etc. It is to be understood that early printers could use "i," "y," and "v" when they chose, as is to be seen in "leprosie," "sayings," "whiche," "verely," etc.

"Z" is, comparatively speaking, a new-comer; and, as can be seen in King Lear, Act II, Scene 2, Shakspere had not the highest regard for it. In early translations of the Bible in Saxon times it was used in "Zaccheus" and similar words, but owing to the fact that "s" had the power of "z," there was little use for the new letter;

"s" was employed for the "zee" sound until the fifteenth century, and even to-day the province of these letters seems to be undefined. There is a large class of words spelt with "ise" and "ize" indifferently. Webster favored a more general adoption of "ize," and in this Dr. Murray, the celebrated lexicographer, agrees, though not to the extent of general change of "ise" to "ize" when so sounded. He favors the change only when derivations from Greek "z" occur.

In the addition of W, V, J and Z to the alphabet, the phonetic principle was observed, and the question may well be asked if this does not furnish a precedent for other changes, the importance of which I shall endeavor, in a subsequent part of my paper, to show.

ETYMOLOGY.—The favorite exception, practically the only exception, taken to the movement for reformed spelling is that the observance of the phonetic principle in spelling English would obscure or destroy the etymology of its words. Max Muller advises the amateur etymologist to leave the subject alone. I shall, therefore, trust to the opinions of the most celebrated etymologists of the century to prove the utter fallacy of the contention that phonetic spelling would interfere with, or conceal, the etymology of English words.

Professor Skeat, of Cambridge, says, "It is really a gross misnomer to call that spelling 'etymological' which imitates the spelling of a dead language. Every student is, or should be, aware that the only true etymological spelling is one which is phonetic. It is the sound of the spoken word which is to be accounted for, and all symbols which disguise this sound are faulty and worthless. If our old writers had not used a phonetic system we should have no true data to go by."

The same authority, in his "Principles of English Etymology," chapter XVI., says: "The subject of English spelling has to some extent been considered in Lecture VIII of Archbishop Trench's well-known and, in the main, excellent work, entitled 'English Past and Present.' But a perusal of that chapter will show that it merely discusses certain spellings from a supposed 'etymological' point of view, and does not at all attempt to deal with the only question of real importance, namely, what is the true *history* of our spelling, and how came we to spell words as we do. I make particular reference to this chapter because I believe that it has unfortunately done more harm than good, as it is altogether founded on a false principle, such as no scientific etymologist would endorse in the present state of our

knowledge. This false principle is, that our spelling ought to be such as to guide the ordinary reader to the *etymology* of the word, because there is 'a multitude of persons, neither accomplished scholars on the one side, nor yet wholly without the knowledge of all languages save their own on the other; and it is of great value that these should have all helps enabling them to recognize the words they are using, whence they came, to what words in other languages they are nearly related, and what is their properest and strictest meaning.' This specious argument has imposed upon many, and will no doubt long continue to do so; but if it be at all carefully examined, it will be found to amount to no more than this, that we ought to spell words derived from Latin and Greek as nearly as possible like the Latin and Greek words from which they are borrowed; and it will be found that most of the examples of the words discussed are taken from those languages. No doubt Latin and Greek form an important element in the English language; but it may be replied that these are commonly the words which are least affected by phonetic spelling. However, the real point is this, that the most important elements are neither Latin nor Greek, but English, Scandinavian and French. The English and Scandinavian elements are carefully kept out of sight by Trench, except in a very few instances; and the French element is treated very briefly and unsatisfactorily, indeed a careful treatment of it would have told the other way. Now, if we are to spell modern English words so as to insinuate their derivation from Latin and Greek, much more ought we to spell them so as to point out their descent from native English, Scandinavian, and Old French. Yet this is a matter quite ignored by the general public, for the simple reason that they are commonly very ignorant of early English, Icelandic and Anglo-French, and so care absolutely nothing about the matter so far as these languages are concerned. Even Latin and Greek they know only by *sight*, and not by *sound*; and there are probably many worthy people who believe that the modern English pronunciation of Latin accurately reproduces the sounds used by Virgil and Horace. Yet if the argument for 'etymological' spelling is to be used at all, it must apply with far greater force to the words which form the back-bone of the language than to such as have merely been borrowed in order to augment its vocabulary."

Professor Sayce assures us that "The objection that reformed

spelling would destroy the continuity of a language or conceal the etymology of its words, is raised only by ignorance and superficiality. English spelling is good for little else but to suggest false etymologies. Etymology deals with sounds, not with letters."

An ex-President of the Philological Society (Eng.), Dr. Murray, has expressed his views of the matter as follows: "My dictionary experience has shown me that the ordinary appeals to etymology against spelling reform utterly break down upon examination. Phonetic, that is to say, truthful notation is absolutely necessary to every student of language."

Another ex-President of the Society, Henry Sweet, M. A., in his 'Handbook of Phonetics,' says: "One of the commonest arguments against phonetic spelling is that it would destroy the historical and etymological value of the present system. One writer protests against it as 'a reckless wiping out of the whole history of the language,' imagining, it appears, that as soon as a phonetic alphabet has once firmly established itself, the existing nomic* literature will at once disappear by magic, together with all the older documents of the language from Alfred to Chaucer.

"As a matter of fact our present spelling is in many particulars a far from trustworthy guide to etymology, and often, indeed, entirely falsifies history. . . . . The idea, too, that because etymology is an amusing and instructive pursuit, it should therefore be dragged into practical orthography, is about as reasonable as it would be to insist on every one having Macaulay's 'History of England' permanently chained around his neck, because history is an improving study. In conclusion, it may be observed that it is mainly among the class of half-taught dabblers in philology that etymological spelling has found its supporters. All true philologists and philological bodies have uniformly denounced it as a monstrous absurdity both from a practical and a scientific point of view."

Professor Whitney, of Yale, Past President of the American Philological Society, in his "Language and the Study of Language," says: "We have already noted it as one of the distinguishing excellences of the Indo-European languages that they are so ready to forget the derivation of a term in favor of the convenience of its practical use; he, then, is ready to abnegate a hereditary advantage of his mode of speech, who, for the sake of occasional gratification

*Nomic—In the customary spelling.

to a few curious heads, would rivet forever upon millions of writers and readers of English, the burden of such an orthography. The real etymologist, the historic student of language, is wholly independent of any such paltry assistance, and would rejoice above measure to barter every 'historical' item in our spelling during the last 300 years for a strict phonetic picture of the language as spoken at that distance in the past."

There is much truth in the words of the editor of "Spelling" when he says, "One of the most persistent objections to the proposed reform of English spelling is that known as 'the etymological objection.' In so far as the phrase implies that the objection is made by etymologists, it is misleading. It is an objection made on behalf of etymology by persons who are not etymologists."

The sound of words should, I think, be quite as important a part of their history as the letters which go to make up the words. However, it would appear that etymology, in the minds of most people, looks for its perpetuation not in sounds but in dumb letters. As it is, our present spelling is frequently misleading, and one has merely to mention such falsifications as: tongue, island, foreign, sovereign, rhyme, delight, nephew, currants, wormwood, belfry, isinglass, causeway, fantastic, and leave to the curious the extension of the list, which can be made with little labor.

Let us for a moment look at the word "calculate." How many of those who use this word from day to day are aware that it is derived from the Latin "calculus," a stone or pebble? I must confess it as my belief that if this and other words were written according to the sound heard in the pronunciation, the purposes of etymology would be quite as satisfactorily served. "Kalkulāt" might look strange, but it would be true spelling.*

If the "c" of "phonetics" suggests to us the Greek "k," why should we suppose that it would be more difficult to discern in "kalkulat" the Latin "c"? After all is said and done, is not the root-meaning of the word "language" practically "tongue-action"? If language be "tongue-action," would it not be well to observe in writing a principle in full harmony with the spoken word? Is it unscientific, is it unreasonable, to make writing to the eye what speech is to the ear?

---

* Even this strangeness would disappear if "c" were used consistently with the power of "k."

If we are to accept the testimony of one who has done much to promote the study of comparative grammar throughout the world, Professor Max Muller, of Oxford, the etymological structure of our language would not be obscured by phonetic spelling. He says, "The pronunciation of language changes according to fixed laws, the spelling is changed in the most arbitrary manner, so that if spelling followed the pronunciation of words it would in reality be a greater help to the critical student of language than the present uncertain and unscientific mode of writing." The same eminent scholar has also stated it as his opinion that "English spelling is a national misfortune."

Benjamin Franklin stated his views respecting reformed spelling in a communication addressed to a Miss Stephenson, in 1768. This letter is written in his own phonetic alphabet, and the intention of the writer is to meet objections to the proposed reform. It is worthy of mention that even then "the wholly mistaken objection," as Professor Sayce terms it, "that all etymologies would be lost," was put forward.

To trace etymologies with any degree of success it would, in my opinion, be of prime importance that the student should not only have a thorough knowledge of his native tongue, and of the principles of scientific philology, but be well acquainted with the other languages concerned in the research. Changes in sound, as well as changes in meaning, follow fixed laws, and he who would trace etymologies successfully must understand the operation of such laws.

"The scientific etymologist," says Max Muller, "would welcome an accurate representation of sounds by symbols; his object is to know what sounds pass into others in the course of centuries, and this he can only ascertain when the spelling represents the pronunciation."

In Dean Swift's time the "etymological" objection seems to have been advanced, else why should that prince of satirists proceed to prove that the Greek and Latin languages were derived from English? I may be permitted to repeat one of his facetious "etymologies" which may prove of some assistance at this stage of a somewhat serious subject. Swift assures us that the name of the celebrated general, Annibal, or Hannibal, arose from the fact that he was an expert in tennis playing, and could, therefore, take "any ball." Alexander the Great, we are seriously told, was very fond of eggs

roasted in hot ashes. As soon as his cooks heard he was come home to dinner or supper, they called aloud to their under-servants "All eggs under the grate." This being repeated every day at noon and evening, made strangers think that the prince's name really was that heard in the command, and posterity "hath been under the same delusion," adds the Dean.

These "etymologies" are quite as probable as many of the popular "origins" so often gravely quoted by contributors to daily papers and weekly magazines, and which the average reader revels in.

In concluding this aspect of the question, to which more attention has been given than the importance of the matter demands, it may well be asked, would not a complete etymological dictionary to which interested persons might refer, much more fully and satisfactorily realize the requirements of the student in search of the derivation of words? How many of the most ardent admirers of popular etymology would risk defining the history of numerous words without first referring to some reliable work on the subject? Each word, like each individual of the human family, has its own particular history, a history which does not concern the every-day use of that word, and it is quite as reasonable to expect to know the history of every man with whom you do business as to insist on the parading of so-called indicators of derivation in words. At the same time be it understood that I do not for one moment confess that phonetic spelling would obscure such etymologies as are at present discernible in our spelling, but would rather assist true etymology. What I desire to state is that etymology is, and should be, a distinct department of study, and ought not to be dragged on all possible occasions into the practical affairs of life, and be unwillingly employed as an enemy to progress and convenience. "Philology," says the learned Dr. Murray, "has long since penetrated the mere drapery, and grappled with the study of words, not as dead marks, but as living realities, and for these living realities it first of all demands—'Write them as they are; give us facts and not fictions to handle.'"

INCONSISTENCIES.—That our present mode of spelling is unsystematic, uncertain, and exceedingly difficult of acquirement must be conceded by even its most zealous champion. What Lord Lytton has said regarding the subject might be considered as bordering

on the profane. However, the task of learning to spell is perhaps equaled only by the endeavor to equip others in this portion of a "primary" education. To spell in accordance with the fashion of to-day is considered an essential of education, and yet you cannot find one person in ten who would risk writing an ordinary letter to the daily press without the aid of a dictionary to assist him in determining the correct spelling of his native tongue. The dictionary has become, to the majority of people, a book to set forth not meanings, but spellings! The present alphabet to say the least is defective. "Digraphs," as Dr. A. J. Ellis, of Oxford, says, "must be looked upon as single letters quite as much as single letters themselves; for they have not the value of a combination of letters, but of one letter. Viewed in this light, the English alphabet will be found to consist, not of twenty-six letters only, but of two hundred! And almost every one of these two hundred symbols varies its meaning at times, so that after having learned one meaning for each of them, the reader has not learned all their meanings; and having learned all their meanings, he has no means of knowing which one he is to apply at any time."

Look at the combination "ea." Observe the changes in sound it undergoes in: bead, dead, breast, beast, sheath, death, beard, heard, sheaf, deaf, lead (to conduct), read (past tense), plead, lead (metal), read (present tense), head, fear, bear. It will be noticed that the substitution of an initial letter changes the sound of the combination, as is also the case when the final consonent is changed. Again: steam, steak, team, tear (to rend), beam, bear, peach, pear, ear, earl, pear, pearl, lean, leant, mean, meant. Mr. Eizak Pitman is authority for the statement that this combination ("ea") occurs in 160 monosyllables, and in a large number of polysyllables, how many he does not say. From this it will be seen that a child or foreigner, learning to read the English language, has to commit to memory the pronunciation of all these words separately, for the spelling will furnish no satisfactory clue. An old verse has it, "Consistencie's a jewell." It can hardly be claimed for our spelling that the bard had it in mind, evenly remotely. The late distinguished Professor Gregory of Edinburgh University, who will be remembered for his chemical attainments and his translations of Liebig's works, contributed the following, in which he ingeniously contrived to spell by what I might term analogy, that is, he employed

a set of letters representing a certain sound in a particular word, to produce the same sound in some other word in which a different set of letters had been used to set forth the same sound. The satirist desired to show the "infignit vareyeety" which English "orthoggerafey" sanctions. It was written in 1846:

" . . . eiveri wone nose thaibt woen grate boossed owve Ingglyshmean yss, thaght itt eez ymnposcible far faurenors theo lirn ourr langwech. Theis, wieth owr seau-cauled aurthografi, ez, unforteanattli, noht choit troe. Buet iph migh meathoud wwer adoppeded aour langgwege wood bei absoughleautli ignakscessible phthoo mounsears ande aul souch stewpid peeple az calnot speek Inglisch. Theye reseaved spaeling aunserz thuis pourpus thollarabli weall, boot ite ise eavideant thabte ohn meigh plagn, phor ah fourenar phtho speal Inglich weil bey, azz ute aught phthough bi, cwite owt ouve theui ckwestiun."

Every spelling in the above can be borne out by some received orthography, and this specimen is given by me not in the spirit of ridicule, for ridicule is a sign of weak argument, but as a very pertinent method of directing those among us who have not given that attention to the question, that the importance of the matter calls for, an opportunity to consider for one moment the almost insuperable difficulties in the way of those who set out to master the spelling of our noble English tongue. Let it be borne in mind that I am not promoting a scheme to reform the English language—I have under consideration here, merely the clothing of that language—and I bebelieve there will not be found many who will maintain that the orthographical garb of a language is *the* language. Because the Italians write "filosofo," and the English "philosopher," can it be argued that the *word*, the innermost meaning, is altered? Can the coat of the schoolmaster transform the dunce into a man of learning, or, on the other hand, can the coat of the fool alter the mental texture of the sage?

Rapp, the German philologist, in his "Philosophie der Sprache," says: "Although the French has become the common language in a diplomatic and social sense, it has never acquired a firm footing in extensive regions out of Europe, and by its bold fusion, with the consequent decomposition, of the forms of its Gothic and Roman elements this idiom [English] has acquired incomparable fluency, and appears especially destined by nature more than any one of the

other living languages to undertake that part. Were not the impediment of a bizarre, antiquated orthography in the way, the universality of this language would be still more apparent; it may, perhaps, be fortunate for us other Europeans that the Englishman has not made the discovery." Those who are busying themselves about the establishment of a "world language" would do well to bear in mind the kind suggestion of our German friend, and join hands with those who desire to place English in such a position as will most rapidly secure that great end. At the Columbian Exhibition next year it is expected that an international convention will be held to discuss ways and means of improving English spelling. May success attend their laudable efforts to bring to a happy conclusion a reform that would confer upon the world at large incalculable blessings!

The past fifty years have done much to spread a knowledge of the aims and objects of the spelling reform throughout the English-speaking world, for which the venerable inventor of Phonography, Mr. Eizak Pitman, of Bath, England, deserves in no small measure the thanks of those who desire to bring to a successful issue so greatly needed a reform. Through the medium of phonetic shorthand hundreds of thousands of people throughout the world have been taught in a very practical and forcible manner the benefits attaching to the substitution of the phonetic for the ordinary or nomic method of spelling. In 1891 the number of primary shorthand books, in one system alone, had reached the enormous edition of 1,600,000 copies, and when captious critics ask what progress the movement is making, the answer is that spelling reform is no longer a possibility, no longer a probability, but a certainty. Phonography has been and is being introduced into hundreds of schools and colleges, where a few years ago it was unknown. This, taken in conjuncion with the fact that the "phonic" method, now being persued in our primary schools, is meeting with great success, is educating public opinion to that point when the demand will come in no uncertain tone for a more simple and scientific system of orthography for general purposes. "Within half a century, too, philology has become a definite science, with definite aims," and, although among the vast majority of people it is no more than an occult science, yet the application of one of its truths in modern shorthand is bringing to the notice of a rapidly

extending constituency of persons the reasonableness of a system of language representation based on phonetics.

The Phonetic Society of Great Britain, with a membership of over five thousand persons, is doing much to promote spelling reform. A large number of those composing the association are familiar with shorthand, to whom the question has presented itself, 'Why should not a system of spelling by sound, which has been employed so successfully in stenography for fifty years, apply in a like manner to our longhand? Why should not science on the one hand meet practice on the other?'

An alphabet to answer all practical purposes should consist of thirty-six letters, representing as many vowels and consonants, which might, if desired, be extended to forty, to include four diphthongs. "Every single sound should be represented by a distinct and unvarying sign, and no sound should be represented by more than one sign. Changes in speech should be followed by changes in spelling." Pronunciation changes according to fixed laws and to prevent spelling becoming archaic, as at present, where we spell in the fashion of Elizabeth but speak in the fashion of Victoria, it would be necessary to follow such changes.

If we are to accept the advice of Herbert Spencer, given no later than November of last year, a complete phonetic system is the only desirable one to introduce, as a partially phonetic or consistent method of spelling would stand in the way of a complete phonetic system. Spelling reformers are, however, constrained to make the transition from the present mode to that advised by the eminent Englishman, by steps. Without doubt the full recognition of distinct signs for all the elementary sounds of our language meets with the hearty approval of all phoneticians, but if this were insisted upon, doubtless there would be a longer postponement of the consummation of their hopes than some persons continue to believe even under the present condition of affairs.

A general adoption of the following rules would simplify English spelling to such an extent that a further step in the right direction would, in the time to come, be comparatively easy to take. To posterity we may, however, leave that matter. What the members of the Phonetic Society are laboring for to-day is the following :—

"FIVE RULES FOR IMPROVING SPELLING, AS A FIRST STEP TOWARDS A SPELLING REFORM.

"RULE 1.—The letters *c*, *q*, *x* are rejected as useless, and every other consonant is confined to the representation of one sound, as every figure represents one number.

"RULE 2.—*A*, *e*, *i*, *o*, *u*, represent the short vowels in *pat*, *pet*, *pit*, *pot*, *put*; and *u* represents, in addition, the vowel in *but*, *double*. The diphthongs in *bind*, *boy*, *bound*, *beauty*, are written by *ei*, *oi*, *ou*, *iu*; and the open diphthong in *naïve*, *Kaiser*, by *ai*. (*I*, in preference to *ei*, is allowed to represent the first personal pronoun.)

"RULE 3.—*Th* represents the two sounds in *breath*, *breathe*, (called, as single letters, *ith*, *thee*,) and the recognized digraphs *ch*, *sh*, *ng*, (called as single letters, *chay*, *ish*, *ing*,) represent the sounds heard in *much*, *wish*, *sing*. *Zh* (*zhee*) is introduced for the voiced *ish* in *vision* (vizhon).

"RULE 4.—In monosyllables, and sometimes in polysyllables, *n* represents *ng* before *k* and *g*, as *think* (thingk), *anger* (ang-ger).

"RULE 5.—The spelling of the LONG vowels is not altered, except in cases of gross irregularity, such as *beau* (bo), *cocoa* (koko), *receive* (reseev), *believe* (beleev), *people* (pepel), *gaol* (jail), because any system of digraphs that might be adopted to represent the long vowels would prejudice the reform. Every letter of the old alphabet is used UNIFORMLY, ONLY for the representation of consonants, short vowels, and diphthongs.

"No chanje iz at present propozed in the speling ov proper namez, or in the teitelz ov buks. This department ov orthografi, ov reit, belongz tu the ownerz ov the namez, the inhabitants ov the plasez, and the reiterz ov the buks."

The change from the present spelling to that recommended in the above would not prevent anyone accustomed to the ordinary printed page from reading the new at once with comparatively little difficulty, and a few weeks would prove ample time in which to write with fair freedom.

It will be seen that the spelling of long vowels is not affected, except is cases of great irregularity. To do this successfully it would be necessary to add new characters to the alphabet, and this is outside the scope of the "first stage."

If the question were asked, "Why is the letter 'e' written at

the end of the words 'bone,' 'stone,' etc.?" I have no doubt the answer would be "To indicate the vowel length of 'o.'" We certainly have come to believe this, but it will be well to remember that the 'e' in this class of words was at one time a distinct syllable, thus making 'bone' a dissyllable. Such a device, says Professor Skeat, "would never have been consciously invented by any sane being. It is the greatest stumbling-block to reformed spelling."

Is it to be deemed a thing incredible that the Anglo-Saxon race should amend its present unscientific and cumbrous orthography? Is it not very unwise, to obstruct the avenue to education with an obstacle such as the present spelling? What stands in the way of reform—sentiment? Sentiment may constrain some to oppose the movement for reform. We respect sentiment—sentiment has been the lever of great actions in other days, and will be in the time to come; however, sentiment has her confines and should not trespass on the ground of education, progress and refinement. Sentiment may induce the artist to choose as the subject for his picture a stage-coach rather than a railway carriage; a sailing-vessel rather than a modern steamship; wild, rocky scenery rather than a well-tilled farm—but then the majority of us are not picture painters, nor, for that matter, word painters. I may hazard the opinion, too, that the artistic sentiment of the painter would not enter into the question if speed, comfort and convenience were under consideration. I think, however, that sentiment can be satisfied if hoary age will at all do so. Our ancestors in the centuries gone by spelt according to sound, and spelling-reformers, recognizing the wisdom of such a principle, desire to return to that laudable method, nothing more.

Other great nations of the world have reformed their spelling. French is fairly consistent, which ours is not. German is practically phonetic, Spanish is readable at once to anyone understanding the sound values of the letters of the alphabet, and Dutch, Italian, and other languages have also been successfully phoneticised. Are we less able than they to perform that work? Cannot the scholarship be found in English-speaking lands to accomplish this end? I say yes, emphatically yes; and it is to be borne in mind that all scholars eminent in the field of philology in England and America have declared in favor of a change. If the English tongue is to become the universal language of the future it must shake off,

as Rapp has pointed out, that orthographic impediment, of which the Rt. Hon. W. E. Gladstone says: "I often think that if I had to set about learning to pronounce English I should go mad. I honestly can say that I cannot conceive how it is that foreigners learn to pronounce English, when we recollect the total absence of all rule, method, system, and all the auxiliaries which people generally get when they have to acquire something that is difficult of attainment. . . . . . I am afraid our language bothers the foreigners dreadfully."

Observation is the key to English spelling. Each word has to be stamped on the memory separately, and when one pauses to consider the large number of words in our language, the task of associating the correct letters in the formation of words seems almost impossible. If we bear in mind the many ways in which the same sound is indicated, and if we were to follow this method in connection with the study of arithmetic what degree of proficiency would be reached by children in our public and higher schools? Imagine the effect, if a child were taught that 1234 stood, and properly so, for one thousand two hundred and thirty-four, and that the combination 1243 represented the number two thousand one hundred and thirty-four, not one thousand two hundred and forty-three; the value of the numerals differing in various combinations! If this ridiculous and inconsistent method prevailed, how long should we tolerate it? Again—What would be thought if to the difficulties already experienced in learning the game of chess this were added, that under certain conditions moves and the values of the pieces must sometimes be altered, and useless pieces permitted to remain on the board? What degree of perfection would be attained if in music flats were to be read for sharps and *vice versa*, the whole matter being subject to no rule but dependent upon the performer's judgment? Some, doubtless, would see value in such a course of instruction, as a means of developing patience, but the majority would not. Our present mode of spelling is not less inconsistent, not less unscientific, not less trying to the young student, than would be the case were an analagous method employed in arithmetic, chess, and music.

If the progress of a people is dependent upon its facility of mental intercommunication, and it must be admitted that language is its means of mental intercommunication, it follows that language

should be easily understood, acquired and used. All irregularities, anomalies and inconsistencies should be eradicated as completely as possible. This would appear especially true in the case of the English tongue, which, like the Anglo-Saxon race, is destined to extend its dominion to every quarter of the globe. In my opinion the greatest obstacle in the way of the universality of the language we speak is its cumbrous and archaic orthography. Despite this the language is rapidly gaining ground, but who is competent to forecast that degree of increased impetus which a phonetic system of spelling would give the conquering Saxon tongue?

The six great nations of the world had, at the beginning of 1890, the following number of followers: Portuguese, fifteen millions; Italian, twenty-nine millions; French, fifty millions; Spanish, forty-five millions; German, sixty-eight millions; and English was spoken by at least fifty millions of the subjects of Victoria, and by an equal number of citizens of the United States. In ten years Portugese rose from fourteen to fifteen millions; Italian, from twenty-eight to twenty-nine; French, from forty-one to fifty; Spanish, from forty-four to forty five; German, fifty-six to sixty-eight; while English rose from eighty to one hundred millions. The question occurs to my mind—of the three hundred and four millions of souls composing the British Empire, how many of these, their children, and their children's children will speak the language of England? Further, sum up the time lost by each unit, composing this enormous national mass, in tracing useless alphabetic characters, calculate the additional time and labor which our present orthographic system demands and which all experience, then multiply this by the millions employing it, and we shall realize how important the question of reform is; we shall see a total loss of millions of years of that most precious of all things—Time.

Reprinting.—It has been urged by some that reformed spelling would render existing books useless, or nearly so. The contention is, however, groundless, for the simple reason that the desired reform would not effect so great a change in the appearance of the words as is generally supposed. In hundreds of words the change would amount to no more than a slight transposition of letters, in others the omission of superfluous characters. The difficulty in reading old works arises from the presence of obsolete words and allusions, and but slightly from the difference in the spelling. The

"suttle theef" of Milton causes us no trouble; "Pittyful weak hammes, gowty legges," in Shakspere's first edition of "Hamlet," does not hide the meaning of the words from us, and, in like manner, reformed spelling would prove a far from difficult task to those accustomed to the prevailing spelling.

STRANGENESS.—The strangeness in appearance of the new spelling is another objection. This, however, is not a very valid one. Were we to write "smoak," doubtless the recipient of our communication would be somewhat surprised, and yet the word was written that way not so many years ago. "Ouisconsin" was the spelling of Wisconsin as late as the first quarter of this century, as can be seen in a book, entitled "A Winter in the West," published in New York in 1834. We might indefinitely extend the list, but few will desire proof in a matter of this kind.

PRONUNCIATION.—Regarding the claim that confusion would arise it reformed spelling were introduced, on account of the present differences in pronunciation, it may be said that there is a received pronunciation which is neither local nor provincial. This pronunciation would be adopted by the majority of people had they the means of acquiring it, and no better means could be found than through the employment of a phonetic system of spelling. I do not claim for the reform that pronunciation would be minutely indicated, that is out of the question in an alphabet for practical purposes, but approximately. It is very doubtful whether the finer shades of pronunciation heard by the trained ear can ever be presented to the eye by means of an alphabet. The phonograph offers the critical student of phonetics means for experiment in this direction, but the generality of people have no great concern in the matter. However, if perfection cannot be obtained in indicating the exact pronunciation of words through a practical phonetic alphabet, it is certain the substitution of an improved method of representing our language would wonderfully improve the pronunciation of the English tongue, and tend to produce a uniformity which does not at present exist. The observant teacher cannot but have noted the marked improvement in the pronunciation of words by the student of phonetic shorthand, and it will be granted by my hearers that the principle ought to apply in a like manner in the case of phonetic longhand. Pronunciation is now learned from hearing the words

spoken by others who are supposed to be competent to govern in such matters. The learner is compelled to remember each word separately, and the extension of the list is a matter of no small difficulty. Give each its independent and unvarying sign, and pronunciation would be made evident to the eye, and it must be remembered that the eye is a more reliable servant than the breath.

Such a diversity of pronunciation exists throughout the English-speaking woild that one can with difficulty understand the words addressed to the ear by people of various sections of the Empire. English spelling, which does not correspond with received pronunciation, is doing much to perpetuate this condition of affairs, and the crying need is for a more perfect method of language representation which shall enable these people to acquire a better and more uniform enunciation of their common tongue. Make pronunciation evident to the eye and changes would in a large measure be checked.

An ingenious Frenchman, Addison tells us, placed on record the intelligence that the ladies of the court of France, in his time, thought it a sign of ill-breeding, and a sort of female pedantry, to pronounce difficult words correctly. Hard words were, therefore, frequently chosen so as to afford the fair ones an opportunity of exhibiting their politeness and good breeding. A lady of note having by accident employed a hard word in the right place and pronounced it properly, the whole assembly was shocked at her breach of etiquette. There are among us some who would welcome such a convenient fashion as this, seeing that the danger under the present state of affairs is not that we shall pronounce words correctly, but rather incorrectly, and that many in high places do pronounce certain words outrageously is evidence of the difficulties surrounding the acquirement of a good enunciation under prevailing conditions.

ECONOMY.—A phonetic system of spelling would reduce the cost and labor of printing and writing by twenty-two per cent. It would enable a child to obtain an elementary education in two years' less time than under the prevailing system. This fact is vouched for by Dr. Gladstone, of the city of London (Eng.) School Board. A book printed in the present spelling and retailing at one dollar would, if phonetic spelling were adopted, sell at eighty cents. The adoption of the "Five Rules," would not of course confer the full benefit of the complete phonetic system, but would be so great a step in advance that people would be convinced in a most practical manner of the

necessity and wisdom of proceeding to the ultimate stage of representing each elementary sound of the language by a distinct and unvarying sign.

The great Forth Bridge, constructed at the enormous outlay of two million pounds, sterling, was built to expedite the journey from Edinburgh northward. The St. Clair tunnel, planned by a gentleman of whom Hamiltonians are justly proud, cost many thousands of dollars (how many I am not able to state). This tunnel was built to facilitate communication between Ontario and Michigan—and yet there stands, and has stood for several centuries, an obstacle, in comparison with which the difficulties experienced previous to the completion of these wonderful engineering feats, were as nothing. This stumbling-block hampers a school child in his battle for knowledge, delays our youth entering higher schools of learning by some two years, forces us to expend over twenty per cent. of time and money more than is really necessary, is a source of no small difficulty to ourselves, and of infinitely more to the foreigner who desires to learn the English language. Unlike those barriers to rapid travelling, which were natural, this is purely artificial, and could be removed at a cost which would fall into comparative insignificance when compared with the outlay of treasure in the Forth and St. Clair enterprises. This barrier to education, progress, and refinement, this enemy of economy of time and money, is our illogical and inconsistent method of spelling.

To reform our spelling, to reform all evils, to spread a knowledge of truth in all its departments, is the spirit of the age which the poet echoes, when he sings:—

"Let knowledge grow from more to more."

The English language is a noble language, rich in perspicuity, exactness and euphony, and were it not retarded by an archaic and clumsy orthography would speedily take the place for which it is pre-eminently fitted. What are we doing to place this wonderful Saxon tongue, enriched by grafts from all languages of the world, in a position to assert her right to universal sovereignty? Why is it so many prefer hobbling along with a defective alphabet and a far more defective orthography? Why so much inertia in a matter of such far-reaching importance?

In conclusion I cannot refrain from adverting to Richard

Steele's contribution to the "Tatler," June, 1710. The subject is a noble one—"On the Love of Country as a Principle of Action." One sentence struck me as being peculiarly applicable to the question under consideration this evening. The words were "But however general custom may hurry us away in the stream of common error, there is no evil, no crime, so great as that of being cold in matters relating to the common good." It may be claimed that I am usurping too high a place for my subject. I cannot believe so. Knowledge is power, and anything that stands in the way of the acquirement and diffusion of knowledge is a national misfortune, nay 'national' is too narrow a term in this age of the world. When primary education is receiving a larger share of public attention than ever before, this question of our spelling must assume greater prominence. When it is of the greatest importance to educate the mind, it is positively cruel, and none the less cruel because sentimental, to force the child to spend its energies upon the mechanics of language, to compel the mind to digest the dictionary to learn the spelling, the drapery, of words. When the mind is being introduced into the realm of education it is cruel to present to the little student, in language representation, chaos instead of exactitude and order. No wonder that the little minds are frequently perplexed over the inconsistencies and anomalies of spelling ; no wonder that the child feels so much difficulty in expressing his thoughts just so soon as a pen is placed in his hand. Is it not easily seen that the mind distracted from the idea sought to be expressed and occupied by the superficialities of words, their ever-changing garb, can have but a moderate degree of success? Why should the mind be obstructed by such a demoralizing obstacle? Ought not some means to be provided whereby the hand might keep company with the mind?

How is a reform to be brought about? By a vigorous presentation of facts in the matter to the people at large, and the education of public opinion to that point which will ensure the success of the movement. Philologists are unanimous in their demand for a better mode of writing and printing words ; that mode, they say, must be phonetic, or practically so. Each individual must do his share of missionary effort in behalf of the reform, and last but not least, the press, which is responsible in a large measure for our present stereotyped spelling, must lend its powerful aid.

NOTES ON THE GENUS RHUS.

Read before the Hamilton Association, March 24th, 1892.

BY T. J. W. BURGESS, M. B., F. R. S. C.

The paper that I have prepared for your consideration deals with a class of plants, which, whether considered with reference to their beneficent or toxic effects on the human race, should be much more familiar to the general public than they now are,—I refer to the various species of Rhus.

The most noteworthy example of this genus in our own country, and the one to which the greater part of my remarks will apply, is commonly called Poison-Ivy. When we consider how common this plant is, and the number of persons liable to exposure to its noxious influence—the laborer engaged in railway work and in clearing bush land, the farmer working about his fences, one of its favorite habitations, and the child so often employed in berry-picking or in gathering the wild flowers with which our woods and meadows abound—I cannot impress on you too strongly the necessity for a thorough knowledge of the various species, their appearance and that of the plants with which they are most likely to be confounded, their poisonous effects and the prevention and cure of these. Some of the varieties being used for domestic purposes, others as medicines, I will also call your attention to their uses in the arts and sciences.

The only representative of the large order, *Anacardiaceæ*, the Cashew family, in northern North America, is this genus Rhus, a name derived from the Greek verb *reo*, "to flow," so called because it was thought to be useful in stopping hemorrhages. Truth to tell, the name was not inaptly applied by our forefathers, all the varieties being possessed of more or less astringent properties, some of them in a very marked degree. The genus, to the non-botanical commonly known as Sumach or Shumach, is composed of trees or shrubs having a resinous or milky acrid juice; alternate leaves; small, regular, greenish-white or yellowish flowers; and a fruit forming a sort of dry drupe.

Not less than fourteen varieties of Rhus are or have been used

in the arts and sciences (the term including medicine), and these I shall, for convenience of description, divide into two classes, native and foreign, dismissing the latter with but a brief mention of their uses.

Of the foreign species there are six.

Rhus Cotinus, sometimes cultivated in our gardens for ornament, under the names "smoke-plant," "purple fringe-tree," and, from the curious appearance of its seed-vessels, which look like a powdered wig, "periwig-tree," is known in commerce as Venice sumach. It is a small tree with purplish-green flowers, supported on hairy peduncles, and is a native of Siberia, Austria and Northern Italy. It is not used in pharmacy, but yields one variety of a wood known in trade as *fustic*, which has been largely employed for producing a yellow dye. A noticeable pecularity about this species of Rhus is that its leaves are simple, like those of the elm and maple, not compound like those of the horse-chestnut and ash, as is the case with the rest of the genus.

Rhus Coriaria.—Of this both the leaves and the berries have been used as astringents and tonics, and the ground twigs as a dye-stuff. It is a native of the Ukraine, in Russia, and has been regarded by the inhabitants, when combined with a decoction of Genista Tinctoria leaves, as a preventive of hydrophobia. It is employed both internally and locally, and the peasantry have great faith it its curative powers, but extended trials in other parts of Europe have shown it to be useless in this much dreaded affection.

Rhus Succedanea is indigenous in Japan. From its berries is expressed a wax sometimes used in pharmacy known as Japan wax. It is of medium quality, ranking between beeswax and the ordinary vegetable tallows.

Rhus Vernicifera, varnish or Japan sumach, inhabits India and Japan, where it is highly prized for its yielding, from incisions made in the stem, a gum from which is made one of the best of varnishes.

Rhus Metopium is found in the West Indies, chiefly Jamaica, and is said to be one of the sources of "hog-gum," extensively used by book-binders in the process of marbling paper. This peculiar, and certainly not euphonious, name is derived from the fact that hogs, when wounded, are reputed to rub themselves against this tree so as to cover the wound with its juice and form a protection against the irritation of insects.

Rhus Semi-alata, a native of China and Japan, yields a gall largely used, especially by the Chinese, in dyeing their famous yellow silks. It is also highly esteemed by them as an astringent medicine.

Of the native species of Rhus I shall speak of eight, and, not to afflict you with their scientific distinctions, I will classify them as poisonous and non-poisonous, confining my botanical descriptions chiefly to the poisonous class, it being most important, to be able clearly to distinguish these from certain non-poisonous plants resembling them. The eight species are equally divided, four being innocent and four highly noxious. And first let me call attention to the non-poisonous varieties, meaning by this non-poisonous by contact with the plant, for, if given internally in large doses, even the innoxious ones act as irritants.

Rhus Aromatica, fragrant sumach—is a straggling bush with tri-foliate, hairy leaves. The pale-yellow flowers, in clustered spikes like catkins, precede the leaves, which are sweet-scented when crushed. It extends from Lake Superior westward and southward, in dry, rocky soil, a variety, the *Rhus Trilobata* of Nuttall, chiefly affecting the Rocky Mountains and Sierra Nevadas. This plant, a a few years ago, had a high reputation among some authorities as an astringent in enuresis, the diarrhoea of children, and the night sweats of consumption, but it has now fallen into disuse to a very great extent.

Rhus Glabra, variously known as sleek, smooth, Pennsylvania and upland sumach is found over the greater part of North America, south of the Arctic Circle. It is a short two to twelve feet high, with straggling branches, covered with smooth, light gray or somewhat reddish bark. The compound leaves, consisting of eleven to thirty-one leaflets, whitened beneath, in autumn change to a beautiful red. Growing along fences, borders of woods, and in rocky fields, its flowers open about July, and the fruit, often eaten by the country people, ripens in early fall. Excrescences produced on the under side of the leaves have been used as a substitute for the officinal galls obtained from the oak, *Quercus Infectoria*. Like galls, these excrescences are due to puncture of the young shoots by a hymenopterous insect to deposit its eggs. This irritates the part and a tumor arises, the result of morbid growth. The eggs enlarge with this growth and are converted into larvae, which feed on the

vegetable matter. Finally the larvae become flies and escape by eating their way out. For use, these excrescences should be collected when of full size, just before the eggs are hatched. All parts of this plant contain a large amount of gallo-tannic acid, and the bark is often used in tanning. The berries have a sour, astringent taste and owe their acidity to malic acid, which, however, according to Mr. Cossens, is not contained in the berries themselves but in the pubescence which covers them. An infusion of the fruit has been used as a refrigerant drink in fevers and as an astringent gargle in ulcerated sore throat.

Rhus Copallina, dwarf sumach, mountain sumach, or the Gum Copal tree, is a shrub with running roots, one to seven feet high, inhabiting rocky hills. The only known station for it in Canada is the Thousand Islands. Its branches are downy, and the petioles between the leaflets are wing-margined. Gum Copal so largely used in making varnishes, is the product of a number of different trees, one of which, according to some authorities, is the Rhus Copallina. The plant possesses similar, but less strongly marked, medicinal properties to Rhus Glabra, already described, and may be used as a substitute therefor.

Rhus Typhina, staghorn sumach, grows very commonly throughout Canada, from Nova Scotia to Lake Superior, along railway tracks and on sterile hillsides. It forms a tree ten to thirty feet high, with orange colored wood. The branches and stalks are densely velvety-hairy, with serrate leaflets pale beneath. This, the the fourth and last of the innoxious species to be described, also possesses properties similar to Rhus Glabra, and may be substituted when that plant cannot be got.

Of the four indigenous species which have poisonous properties, one is an inhabitant of the Southern States, and a second of California, while the third and fourth are common in all parts of North America between the 35th and 60th parallels. Since their poisonous, and probably their therapeutic, effects are similar, I will first give a short description of each species and devote the remainder of my remarks to the physiological and therapeutic actions of Rhus Toxicodendron, the common form of poison ivy in Canada.

Rhus Pumilum, growing only in the Southern States, and very common in North Carolina, is a pubescent shrub, about a foot high, said to be the most poisonous of the eastern varieties. The pinnate

leaves, consisting of about eleven oblong, coarsely-toothed leaflets, are downy beneath. The three upper leaflets are often confluent, the terminal one, when distinct, being alternate at the base. The flower panicles are nearly sessile, with the drupes are covered with a red, silky pubescence.

Rhus Diversiloba of Torrey and Gray, or Rhus Lobata of Hooker, approaches very nearly to Rhus Toxicodendron. It is generally a shrub, but sometimes a climber, and is said to be the most poisonous of all the Rhuses. It is chiefly a native of California where it is known by the Spanish name of "Hiedra," but is said by Douglas to occur on the north-west coast. Its leaves consist of three, rarely five, obtuse lobed leaflets; its flower panicles are shorter than the petioles; and its fruit is white and pubescent. With her usual generosity, nature, according to Dr. Canfield, provides an antidote to poisoning by this species in the shape of another Californian plant, the *Grindelia hirsutula*, of which either the bruised plant itself, or a decoction, is applied to the parts.

Rhus Venenata, formerly called *Rhus Vernix*, is known by the different names of poison dogwood, poison elder, poison ash, poison sumach, swamp sumach, white sumach, and varnish tree. Affecting rich, swampy ground, in shaded situations, it is a shrub or small tree usually growing from six to eighteen feet high, and is one of the largest of our native species of Rhus. The trunk seldom exceeds three inches in diameter, and, branching at a height of three to five feet, usually makes a repeatedly two-forked ramification, the final twigs terminating in thick clusters of leaves. The smooth bark is dark gray on the trunk, lighter on the branches, and reddish on the twigs and petioles. The leaves, expanding in May, are at first dark yellow in color, but become deep green with a paler under surface when mature, and finally, at the first touch of frost, assume a beautiful deep crimson hue that can fairly vie with the maple for brilliancy of effect. The seven to thirteen leaflets forming the compound leaves are obovate-oblong in shape and entire. The small yellowish flowers are arranged in loose and slender axillary panicles, forming large masses of fragrant bloom at the ends of the branches, which attract innumerable swarms of bees. Whether the honey derived from this source possesses any poisonous properties I am unable to say, but, as at various times there have been reports of poisoning by honey in particular localities, it would be a point well worthy of in-

vestigation whether this form of poison-ivy does not also abound there. The berries, ripe in October, are whitish or dun-colored, with striate stones, and look somewhat like bunches of small grapes —a similarity, however, which need give rise to no error, as a glance at the leaves shows them to be *compound*, whereas in the grape they are *simple*. Taken altogether, this Rhus is one of the handsomest shrubs imaginable when in bloom, but is unfortunately one of the most dangerous. Rhus Venenata has been thought to be identical with the *Rhus Vernicifera* of Japan, and when incisions are made into its bark there is a copious flow of viscid fluid, yellowish at first, but soon changing to a deep black, which, when boiled, makes a fine varnish. The poisonous properties of this tree are said to be more powerful than those of Rhus Toxicodendron, persons exposed to its influence being more apt to suffer, and more severely. I have known several cases of poisoning due to this plant being mistaken for the common elder, an error which could never arise were the fact borne in mind that both varieties of elder, found in this country, have the margins of the leaves toothed, whereas in Rhus Venenata they are entire. In addition, the elders have dense masses of flowers, and a fruit which, when ripe, is either red or black, while the form of poison-ivy has slender, scattered bunches of flowers, and a fruit whitish in color when mature. Rhus Venenata is not very common in Canada, but is occasionally found in the western part of Ontario. The recorded localities are Weston, Port Colborne, Niagara Falls, Hatchley and London, Ont.

Rhus Toxicodendron may be made to include *Rhus radicans*, as botanists are now pretty well agreed that it is but a variety of the former, its differing form and characters, viz., more entire leaflets and high climbing stem, being dependent on the circumstances of its *habitat*. Rhus Toxicodendron was first described in 1635 by Cornutus in his work on Canadian plants, as a species of ivy. The Indians were well aware of its properties, and its effects were mentioned by Kalur and other travellers in North America. Poison oak, poison ivy, poison vine, poison creeper, and sometimes poison mercury, are names applied to it. It is very common throughout Canada from Nova Scotia to the Saskatchewan at Fort Edmonton, and is also recorded as occurring in woods near Yale, British Columbia. It is commonest in fertile and low grounds, but will thrive in barren and elevated places, and attaches itself to any bodies in its

vicinity by numerous thread-like rootlets given off from the stem. Sometimes it climbs spirally to the tops of our tallest trees, attaining a height of forty or fifty feet, again it is met with along the sides of fences which serve as a convenient support, or crawling over bush or rocks, along the ground, in which cases it never exceeds from one to three feet in height. This low form sends off many small branches, the pendulous extremities of which often give the plant a bushy appearance. The stems are from a quarter of an inch to two inches in thickness, and covered with a grayish-brown bark. The leaves, which are said to be eaten by cattle with impunity, are trifoliate; the leaflets being rhombic-ovate, pointed, pubescent beneath, and variously notched, of a shining red when they first appear in spring, but bright green at maturity. The flowers are small, greenish-white in color, and disposed in simple axillary racemes. The fruit is a round, dry berry, about as large as a pea, of a pale green color, and ripe in October. As in Rhus Venenata, from the bark when wounded exudes an acrid, milky juice, which exposed to the air for a few hours changes to an intense black, which will leave indelible stains on linen or cotton, not effaceable by any known chemical, and which has been used as a marking ink. The researches of Professor Maisch have proved that the acridity of the juice of Rhus Toxicodendron is due to the presence of a hitherto unknown volatile acid, analagous to, but distinct from, formic and acetic. Toxicodendric acid, when isolated, is found to affect the skin, either by direct contact or by its vapour, exactly as the fresh plant itself does, proving beyond doubt that the poisonous properties of the plant are due to it. This principle is in a great measure dissipated in the process of drying, and hence dried preparations of the plant are much less apt to act noxiously, though even these should be handled with great care by such as are susceptible to poisoning by it. The plants for which Rhus Toxicodendron is most often mistaken are the Virginia Creeper or American Ivy (*Ampelopsis quinquefolia*) with which the climbing variety often entwines itself, and the *aralias nudicaulis* and *quinquefolia*, commonly known as Wild Sarsaparilla and Ginseng, often found growing with the low form. These plants are very easily distinguished if one will take the trouble to remember a single simple distinctive mark, viz., that they have *five* leaflets on a single leaf-stalk, whereas the poison ivy has only *three*. Other distinguishing marks are that the aralias have

regularly serrate leaves and in nudicaulis the flower-stem is separate from the leaf-bearing one.

The toxical effects of the poisonous species of Rhus are produced in various ways and degrees of severity, but in all cases they are due to absorption by the system of toxicodendric acid. They may be the result of direct contact with any part of the plant or its juice; of exposure to smoke from the burning of it; of inhaling the steam arising when making pharmaceutical preparations of it; of internal use; and of emanations from the growing plant. The most specially noteworthy of these methods of poisoning is that by exhalations from the living plant itself. According to Cazin, such exhalations are only given off when the plant is not exposed to the sun's rays (as when it grows in the shade and at night) and consist of hydrocarburetted gas mixed with toxicodendric acid in a volatile state. That they will cause poisoning in those exposed to their influence, without actual contact with the plant, and even at considerable distances, is doubted by many scientists, but there is considerable weight of evidence pointing that such is really the case. Wyville Thompson, of the late *Challenge* exploring expedition, states that among the blacks of the West Indies there is a *superstition* that some species of Rhus will poison without actual contact. Aboriginal traditions are rarely found to exist without some foundation, and in this case so strong a one that it should have prevented the report being called a superstition without fuller investigation. I could cite a number of instances of poisoning, both recorded and coming under my own notice, where all the evidence goes to show that there was no possibiliiy of contact with the plant. "A lady of known susceptibility was attacked after being out driving, though she had never left the vehicle, which kept the centre of the road. Here the nearest distance of possible exposure would be that of plants growing, where they were afterwards discovered, along the fence, a distance of over twenty feet." Again, a medical friend of my own experienced a severe attack after passing, at a distance of at least three feet, a thicket in which grew a mass of the plant; while a gentleman so noted in the scientific world as to vouch for the accuracy of his powers of observation, while engaged in geological researches, found to his cost the effect of passing some, though he had previously noted it, and was hence most scrupulous not to let it touch him. It seems to me, too, that the knowledge of this method of poisoning

by Rhus is peculiarly interesting as offering a plausible solution of what are generally regarded as fabulous stories of the deadly effects of the upas tree of Java, under which the wearied traveller laying himself down sinks into that sleep which knows no waking. Is it not at least within the bounds of possibility there may be a Javanese tree possessing similar, perhaps stronger, noxious properties to Rhus Toxicodendron, and thus capable of poisoning its surrounding atmosphere?

The poisonous effects of Rhus are both local and constitutional, according to the idiosyncrasy of persons; acting upon some only locally, upon others only constitutionally, and upon yet another, and the most frequently met class, in both these ways. A certain constitutional predisposition is requisite for the occurrence of poisonous symptoms, many individuals being quite insusceptible. I myself am a case in point, having often rubbed both Rhus Venenata and Rhus Toxicodendron, as well as their juices, over my hands and face without suffering the slightest inconvenience therefrom. To illustrate the peculiar virulence of this plant toward some constitutions, I might state that the celebrated chemist Fontana, knowing himself to be easily poisoned by it, and wishing to examine into its properties, caused specimens to be got ready by another person, but accidently touching one of the leaves, under some water into which it had dropped, in a short time began to suffer from its poisonous effects. This susceptibility varies greatly under certain conditions of animal and atmospheric temperature. In some persons a difference is observable whether in a warm or cold climate, and some suffer only on very hot days. With others climate and season seem to make very little difference. Children are much more liable to be poisoned than adults, and females than males. When the skin is moist the poison is more readily absorbed. A gentlemen who had often handled the plant with the greatest impunity, experienced his first attack through rubbing against some of it while his skin was still undried after bathing, and though he has several times since rubbed the plant over the dry skin, has suffered no ill-effect. For this reason also, persons perspiring, especially if fatigued, are more liable to be affected.

Instances are related in which a periodical return of the symptoms of poisoning, without fresh exposure, has occurred for a number of years. This is doubted by some, who ascribe the

succeeding attacks to fresh exposures to the plant's emanations, without the patient's knowledge. An able advocate of this view thus expresses himself in regard to the poisonous emanation: "Being volatile, it may be readily diffused, and like malaria or the cause of hay-asthma, may act under favorable circumstances, as of aerial currents and susceptibility in the recipient, at a considerable distance from its source. Now it is well known that no protection is conferred by a prior attack, and hence it might reasonably happen, that a person having suffered from ivy poison one season, would also suffer the next by reason of susceptibility, even though scrupulous precautions should be taken to avoid direct exposure. In such a case the diffused emanations might be sufficient as an exciting cause to account for the recurring attack. It is to be noted that the so-called recurring cases always take place during the summer season, and at the period of the plant's poisonous activity, but never in the winter, which lends support to the supposition of the existing cause being diffused in the atmosphere." These plausible arguments do not however, to my mind, clear up all the reported cases of recurrence. A gentlemen was poisoned one year in this country, and the next he went to Europe, where, at the same season of the year as that when he was first poisoned, most of the symptoms returned. Now, being in Europe, he could not be exposed to the noxious emanations of poison ivy, and the opponents of the recurrent theory would have to fall back on the far-fetched argument that he might have been exposed to noxious effects, resembling those of poison ivy, from some poisonous shrub of Europe. Further, in some cases the eruption is said to have returned annually for several years, and one can hardly imagine a person suffering a number of consecutive attacks without noting his fresh exposure in at least some of them.

In the New York "World" last year there appeared in an article, by one Edmund Collins, on the poisonous rhuses, the following extraordinary statement: "Every one does not know what is the meaning of the term 'poison-ivy.' They do not know that a little while after touching the leaves or branches of a poisonous tree or ivy, a vivid red rash appears upon the hand, wrist or leg, and then spreads over the whole body. A microscopist removes a little of the rash, puts it on the slide of the microscope, and, under a glass with a magnifying power of 300 diameters, sees an active little para-

site. This parasite lives in millions on the 'poisonous' tree or plant, but when the leaf or stalk where they cluster is touched by one's hand or wrist, a score or more of them may be found clinging to the skin. They cannot be seen with the naked eye, but they may be removed by the edge of a sharp instrument and put on the slide of a microscope. They are rather oval in shape, and have a wonderful power of reproduction. Suppose a child touches a leaf or stem with his hand or wrist, five or six of these parasites get upon the skin, huddling close together, and remaining in the same spot for hours. The child doesn't feel them and can't see them, but the pests at once begin to burrow under the skin, feeding and building nests. In a short space of time they have increased a thousandfold, after which they all move about, making little settlements all over the the body, turning the skin rough and red, and producing a torment of itching. These parasites are communicated even by shaking hands, though the bacillus (which it really is) will not burrow so readily in the skin of an adult as in the softer skin of a child. I have known about eighty per cent. of a school, consisting of nearly sixty pupils, to be contaminated by one small boy who had the rash of poison ivy on his wrist. He was the only one in the school who had been in the woods, and he had brushed through a clump of poison ivy. It was the belief down to a very late period that the poison from these plants was an acid or sharp juice, which, getting upon the skin, irritated the part and set up an inflammation. The modern microscopists know it is a parasite which can live on the petals or stems of the plants named, or on human blood, and thrives best on the latter. The two poison sumachs are provided with a thick, viscid juice, which exudes when a branch, stem or leaf is crushed or broken. In this matter are myriads of the parasites, but, as already stated, they are communicated to the skin by the brief contact of any exposed portion of the hands, arms, face, or any other part of the body."

On reading this strange statement I at once communicated with Dr. Van Harlingen, of Philadelphia, one of our best authorities on skin diseases, who told me, as I had surmised he would, that the statement was a mere newspaper "yarn," which advanced an utterly untenable statement, and one of which he had never even heard.

The symptoms of rhus poisoning are violent itching, redness, burning, and erysipelatous swelling of the parts subjected to its in-

fluence. The face and hands are most apt to be affected, in some cases the swelling being so great as to obliterate the features, but any part of the body may present similar appearances. Of poisoning by its internal use there are five cases on record. In one instance two children, aged respectively six and eight years, ate the berries ; and in the other, three persons, a boy aged twelve and two girls aged fifteen and seventeen, took an infusion of the root in mistake for one of sassafras. In a few hours there was drowsiness and stupor, followed by vomiting, convulsions and delirium, and in some of the cases there was an eruption over the body. All these persons recovered after varying intervals.

The prevention of poisoning by the rhuses should be strongly impressed on the community at large. Everyone should know the distinctions, which I have already given, between the various species and the plants with which they are most liable to be confounded. Being worthless and of little value except medicinally, and even then probably much overrated, they should be extirpated by every thrifty farmer. A strong alkaline solution, used immediately after exposure, will often prevent the poisonous effects of rhus on those known to be susceptible to its influence, while anyone obliged to work near poison ivy should smear his face and hands freely with sweet oil or grease, when no ill effects are likely to follow.

REPORT OF THE COUNCIL.

Read at the Annual Meeting, May 12th, 1892.

The Council have much pleasure in submitting their report for the session 1891-2, and especially in directing attention to the progress the Association has made since the last annual meeting.

Twelve meetings of the Council have been held, the proceedings of which have regularly been reported to the Association.

Shortly after the election of the present Council, arrangements were made for holding a number of special meetings of the Association, at the first of which, held on the fourth Thursday of September, Professor Ramsay Wright, of Toronto, kindly consented to be present. In all fifteen general meetings of the Association have been held during the year, the average attendance being fifty-four. The following is a list of the titles and authors of the various papers read :

Sept. 24.—" Microbes—their Life and Work," an address by Professor Ramsay Wright, of the University of Toronto.

Oct. 8.—" Notes on Fossil Silurian Plants," by Col. C. C. Grant.

Oct. 22.—" How we Measure," by W. H. Ballard, M. A.

Nov. 10.—" The Study of Biology," Inaugural address by the President, A. Alexander.

Nov. 26.—" A Criticism of our School System," by Rev. A. Burns, D. D.

Dec. 9.—" Canada: its Canals and Waterways," by H. B. Witton.

Jan. 14.—" Memory," by S. B. Sinclair, M. A.

Jan. 28.—" Man Scientifically Considered," by J. Alston Moffat.

Feb. 11.—" The Chemical Reactions of the Bleaching Processes," by J. B. Turner, B. A.

Feb. 25.—" Messengers from the Skies," by H. B. Small, of Ottawa.

Mar. 10.—" Fungi affecting Fruits," by L. Woolverton, M. A., of Grimsby.

May. 24.—" Spelling Reform," by C. R. McCullough.

April 14.—"The Jews and the Persecutions in Russia," by W. H. Schofield, B. A.

April 28.—"Notes on the Genus Rhus," by T. J. W. Burgess, M. B., F. R. S. C., of Montreal.

May 12.—The Origin and Development of the Horse," by Wm. Mole, M. R. C. V. S.

Two sections of the Association known as the Physical and the Philosophical were organized in November; these and the three previously existing will submit reports of their work during the year. Within the past month a Camera Club has been organized as a Photographic Section of the Association, and the prospects for good work in it are exceedingly bright. Working rooms have been secured for it and the Physical Section within a short distance from the Museum.

One corresponding member and fifty ordinary members have been added to our list during the year; one has withdrawn, and two, Charles Robertson, M. A, and Thomas C. Mewburn, have been removed by death. Mr. Robertson was Chairman of the Philological Section from its formation, and took a deep interest in its welfare. His death, mourned by all who knew him, will be a severe loss to the Association. Mr. Mewburn was a especially frequent and valuable contributor to the Museum, and the collection which he has left us will constantly remind us of his worth.

A number of valuable donations to the Museum have been made during the year, and increased shelf accommodation has had to be provided. The Council would call attention to the necessity for placing in a public collection as many as possible of the Indian relics in which this district abounds, and will undertake on behalf of the Association the care of all entrusted to it.

The last issue of the Journal and Proceedings of the Association was sent to a largely increased number of Societies, and most of these have in turn sent us copies of their transactions, many of them of great value. Seeing the importance of enlarging our exchange list the Council have determined to issue a larger number of copies of this year's Proceedings: the publications received from other Societies are at all times easily accessable to members.

The Council would recommend that Mr. H. B. Small, of Ottawa, an honorary member of the Association, be our representative

at the approaching meeting of the Royal Society of Canada, and that our annual outing to held at Grimsby on Saturday the 11th of June.

All of which is respectfully submitted.

A. ALEXANDER, *President.*   A. W. STRATTON, *Secretary.*

REPORT OF THE GEOLOGICAL SECTION.

Read at the Annual Meeting of the Association,
May 12th, 1892.

The Section, in submitting this report, desires to state that an active interest has been maintained by the members throughout the year, and many valuable specimens have been added to our already large and representative collection.

Nine meetings have been held, at eight of which papers were read. The Section is deeply indebted to the untiring energy of its chairman, Col. C. C. Grant, who has contributed all the papers.

The papers read have been as follows:

1891.

May 22.—"Irish Celts and their Relics, III," (published in last years' Proceedings.)

June 26.—"Notes on the Niagara Falls Rocks."

Sept. 25.—"Geological Notes on the Marl Lake, Anticosti."

Oct. 23.—"Fossil Plants, Hamilton," supplementary notes to the paper read before the Association on Oct. 8th.

Nov. 27.—"The Fossils of the Cretaceous and Eocene Formations, I."

Dec. 25.—"The Fossils of the Cretaceous and Eocene Formations, II."

1892.

Feb. 26.—"Fragments of Palæozoic Sea Floors."

April 22.—"Mesozoic Reptiles. Have they any living representatives?"

At the meeting of Jnne 26th, the following fossils were reported as having been found on the Field Day:—Favosites Niagarensis, Caryocrinus Ornatus, Caenostoma Constellatum, and a new variety of Stromatoporæ.

A number of specimens have been added to our collection during the year, for which we are especially indebted to Messrs. Charlton and Walker and the Geological Survey of Ottawa.

Respectfully submitted,

A. T. NEILL,
Secretary.

NOTES ON THE NIAGARA FALLS ROCKS.

Read before the Geological Section, June 26th, 1891.

BY COL. C. C. GRANT.

So much has already been written regarding the Falls of Niagara that no point seems left for investigation. The rate of recession has been determined by a host of writers, who widely differ on the matter. I may add, however, that periodical surveys have been made within the past fifty years, by which it is computed the gorge at the present time recedes about 2.4 feet in the year. This recession must have been much slower when harder material than the earthy shales rested at the base. As the river gradually cuts back its way to Lake Erie, owing to the dip of the beds, about twenty-five feet in a mile, the Niagara limestones now at the top must occupy the lower position of the softer layers, and then its backward course will be considerably checked.

While all I have stated is already known to the senior members of the Geological Section, I feel assured they will pardon me for explaining to our younger brothers of the hammer. The rocks exposed in this neighborhood in descending order are as follows: Boulder clay and gravel, containing fresh water shells have been found resting on Niagara limestone, overlying shales and limestones of the same series, followed by the Clinton beds, which are about eighty-five feet in thickness and particularly well displayed along the Niagara escarpment near Hamilton. This overlies the Medina beds, shales capped by a freestone band, known as the grey band. All except the first (Post-pliocene) contain corals, marine shells and encrinites, in addition to fucoids or sea plants. No reasonable doubt can be entertained respecting the occurrence of the sea lilies in the Medina sandstone. No crinoid, as far as I know, has ever been discovered here or elsewhere in these beds; fragments of the stalk of two distinct species were obtained, and both were in better preservation than the Tentaculites (unrecorded) found at the like horizon. I may notice here that in many instances these marine remains have been mineralized or converted into iron pyrites.

I have already explained the difficulties we encounter in recognizing fossil algæ fucoids, decayed as many were when imbedded, and the internal structure so flattened and compressed that the microscope can afford little if any light, even when fairly preserved specimens are obtainable. However, I may state, the grey band contains about seven or eight species of plant remains. I forwarded to Sir Wm. Dawson some in excellent preservation from an abandoned quarry near the reservoir; but as I intend to call the attention of the section to this class of fossils on a future occasion, I need say no more on the subject now. If any of our members should ever pay a visit to Grimsby, by following up the bed of the stream you may collect well preserved examples of the Arthrophycus Harlani, a branching fucoid which some palæontologists think represents the filled up sand burrow of an extinct Crustacean.

The Niagara shales in the high cliffs to the right as you enter the ravine there from the Grimsby road, hold numerous heads of the well-known encrinite, Caryocrinus ornatus. A few have been collected by Hinde and Nicholson along the banks of the river Niagara, also below the Falls.* It has been remarked, when you find a single specimen of this sea lily you are almost certain to unearth an entire colony of the crinoids by searching carefully. About four feet from the base of the Niagara shale, near the rock cutting, Hamilton and Erie Railway, I found nearly three dozen in a few days, shortly after the line was opened, also two heads of the fine crinoid, Eucalyptocrinus decorus, and upwards of fifty of the singular little encrinite, named Stephanocrinus angulatus. All were previously described by Dr. Jas. Hall, or other geologists, as characteristic of a like Silurian horizon in the State of New York. The Silurian star-fish, Petraster bellulus, described and figured in the Palæozoic Fossils of Canada, was discovered at Stony Creek by an old friend of mine, Johnson Pettit, of Grimsby. Unless this locality is included in the township of his residence, the error admits of rectification. He pointed out to me the exact spot where he extracted it from the Niagara shales. We have no reason to suppose that such rare fossils are confined to particular parts of the elevated sea bottom. The red and mottled shales of the Medina series, running out near Oakville, only contain a few ill-preserved

* The exact locality they refrain from making known.

plant remains. The absence of free shell, for instance is very remarkable; but, although the 340 feet of it in Canada has been carefully examined by field geologists, it has only yielded the doubtful fucoids. Not long since it was thought to be a deep sea deposit, and this may account for it. Such an idea cannot be entertained. Deep sea dredging expeditions revealed the secrets of the sea's abysses. The capping band (sandstone) points to an ancient coast line, and seemingly it was deposited in shallow water. Prof. Wilkins' idea that the shales were laid down in a sea impregnated with mineral salts injurious to life, appears to be more worthy of consideration than any other theory advanced on the subject yet. He certainly deserves great credit for boldly grappling with a disputed point which few field geologists would dare encounter, and the majority are anxious to carefully avoid. All the four Clintón bands, red and green, are fossiliferous, they thin out to the east, the lower ones contain star-fishes and crinoids, one of the latter, probably undescribed as yet, is exceedingly delicate. It possesses so slight a stalk that I was induced to suppose it could only exist in some well-sheltered cove or bay, protected from wind or wave, or in deep water where their influence is unfelt. All the beds of the May Hill sandstone series, known to us as Clinton, I examined on this continent, were laid down in shallow water. Apparently the portion called the Iron band is well displayed in rear of the small reservoir at Hamilton, and is of great interest. It contains many plants, differing altogether from fucoids in their nature. They may not be land plants in the usual acceptation of the term, but I believe them to be allied, if not identical, with the ones Sir Wm. Dawson mentions as growing in marshes, with only their upper parts in the air. They are distantly related to the "mare's tail." The iron ore, peculiarly characteristic of the upper red band, was derived from plants, I think, which grew in low swamps to which the sea had access occasionally as litoral shells, lingulæ, etc., are found in it.

Probably the sea bed was undergoing slow submergence when the overlying band, green shale or sandstone, was deposited. Burrows or casts of the lob-worm, and thin ripple or wave-marked layers, may be noted through its entire thickness. The Pentamerus bed, Niagara limestone, lying on the upper part, attaches to its under surface about two inches of the compressed shale; this holds an alga, perhaps a new species. In addition to the large shell Pentam-

erus oblongus, the base of the wenlock or Niagara holds seven species of graptolites. The still larger Stricklandinia of the late Professor Billings is generally obtained from the second layer below the thick four and a half foot bed known to the quarrymen as the Nigger-head. This is the one you may remark lying so frequently at the foot of the escarpment from which it has fallen. The Niagara shales, seventeen and-a-half feet thick at Hamilton, contain many graptolites, but they fall to pieces when they become dry. There are, however, interspersed in the dolomitic shales a few impure layers of limestone from which good specimens are obtainable, as also the fucoid Buthotrephis Granti. The blue building beds overlying, about five and-a-half feet in thickness, contain a great many graptolites, and the two upper beds are rich in trilobite remains, head and tail shields, but a complete one is very rare indeed. Conularia magnifica (Spencer) and C. Niagarensis also occur, perhaps in better preservation than in the chert macadamizing beds, higher up. From the base of the latter, about two feet above the limestone band, I secured the fragments of the great crustacean, Pterygotus Canadensis, the predecessor of Pauglicus, of the Devonian rocks of Scotland.

It would afford much pleasure to point out the position of the most fossiliferous chert and Niagara-Barton beds near Hamilton. The waterlime quarry of the latter is the only one now open, and presents but few specimens, the fossils of the higher layers in many instances, Trochoceras displanense for example, are like Guelph shells.

When we consider the very limited time at our disposal, and that the Falls themselves and neighborhood have been the common hunting ground of many thousands of geological tourists from all parts, I do not think we should be ashamed of the small collection we made during our visit. We may claim to have discovered that the higher Barton beds at Lime Ridge, near Hamilton, are also represented there, a circumstance hitherto unnoted. I noticed particularly two circumstances on our recent visit to the Falls. They have been rapidly receding during the past twenty-five years, and the body of water is very sensibly diminished since I saw them in 1867. I experienced no difficulty in approaching the part known as the Horse Shoe Falls, over rocks formerly partly under water. Despite the protection vegetation affords, the high cliffs below the

cataract are also retreating in some places, not so much from the river undermining the banks, although perhaps, at some points such was the agent, but chiefly from the expansive power of the frost during the winter season, which is sufficient to rend asunder and disintegrate the face of the hardest layers exposed to its influence. You may notice at the upper reservoir, every year, what a vast amount of loosened material has to be carted away when the frost disappears. It must be admitted we committed a grave error in not taking a chisel or two and a heavy hammer with us. Had we been provided with them we could have added a considerable number of much better specimens to our collection of stromatoporæ, strange fossils, to which Mr. Walker recently called your attention, whose classification remains as yet undetermined.

Dr. Spencer, who has studied the Field Geology of the Niagara District most carefully alleges the Falls commenced their history when the lake level of Ontario was 138 feet higher than at present, the predecessor of the modern body of water he calls Lake Iroquois. I consider his conclusion quite correct regarding its existence since the glacial period; but I believe the vast inland sea, fresh water, he has named Lake Warren, existed before the great Ice Age. Could any quantity of lake ice have scored and polished with such regularity the glacial markings we see every where for miles around us, or deposited moraines of the dimensions we meet with on the brow of the mountain?

GEOLOGICAL NOTES ON MARL LAKE, ANTICOSTI.

Read before the Geological Section, Sept. 25th, 1892.

BY COL. C. C. GRANT.

Perhaps the most interesting spot on the Island of Anticosti to the field geologist is the small lake so appropriately named by Richardson in his report addressed to the late Sir Wm. Logan. He remarked, near the village of English Bay, the chief settlement on the northwest shore, a little brook of milky appearance which left a considerable deposit of carbonate of lime not only on the bed of the brooklet itself but for a considerable distance into the bay. Following it up, I presume, under many difficulties, he found it proceeded from a swampy lake, in size and appearance not unlike Medad, near Waterdown: It lies perhaps about a mile or more inland from English Bay. The inhabitants of this village, including women and children, amounting to 1000 or so when I was there, were, with few exceptions, French fishermen. They build their own houses of frame work, neatly constructed, internally clean, and whitewashed on the outside with the marl derived from the lake. Lime kilns are structures apparently unknown to these Celts, long separated from the ancient stock of the mother country, France.

From the distant shore of this lake when it is frozen over, they obtain by means of dog sledges the greater part of the fuel supply. A rough passage from the village to the near margin has been cut through the dense bush. In winter, no doubt, it would prove more practicable than it appeared to me in autumn, when obliterated by a season's growth of underwood, tall ferns or branches. Indeed I found the pathway so obliterated, even close to the lake shore, that I lost it completely, and, on my first visit, it must have cost me some hours' hard work to worm my way through a few hundred yards, exposed to gadflies and mosquitoes. With great difficulty I had a light skiff conveyed over land and launched on its waters, by means of which I ascertained that the Marl Lake itself is merely the outer one of a chain stretching inland, connected by brooklets. There is little doubt that at a very recent period they formed an uninter-

rupted body of fresh water. I was particularly anxious to ascertain if the apparent drainage was owing to a recent coastal elevation of the island. I have already adduced proof that Anticosti is undoubtedly rising, while the continent to the south along the Atlantic coast is said to be gradually undergoing a marked depression.

The Marl Lake is quite shallow at the edges all round, the shore line sandy in patches. In the centre I found it scarcely exceeded six feet in depth. I was quite astonished at the immense thickness of the marl deposit; even a few feet from the margin a pole twelve feet long was thrust through it without finding the bottom bed. On removing a portion of the peat soil adjacent, clear proof was obtained in several places that the former body of water was much greater than now. It has simply shoaled up and shrunk to its present dimensions by means of the countless myriads of fresh-water shells extracting the lime for the purpose of forming their habitations in much the same way as the coral reefs are raised to the surface. However, the marl lake molluscs differ from the coral insects, they do not form a consolidated mass, as was clearly shown by the pole so easily penetrating in the way it did. Dr. Geikie considers that many of the plains in the United Kingdom were originally lakes. The same may be said of the mosses or bogs in Ireland. In numerous instances I noticed shell marl underlying the peat, but the average thickness was inconsiderable, a few feet perhaps; when dry it was not unlike chalk.

Mr. Robinson, who accompanied me on my second visit to Marl Lake, had but little difficulty in getting the light skiff back to the village by the brook, which connects it with the bay. During my stay at Anticosti, a lad brought in some fine speckled trout from the brooklet which flows from the lake beyond, seen at a distance only, into the one we explored.

I ascertained at the South Point Lighthouse that another lake was discovered some two miles inland. The keeper kindly volunteered to accompany me. By following bear paths and wading through swamps, we at last arrived at our destination. I found the Little Marl Lake also had a rich deposit of shell marl, admitting, however, of no comparison with that near English Bay. Strongly acidulated springs, I believe, were only capable of dissolving the enormous quantity of lime in solution in the latter. May not this explain why cattle, as was stated, frequently appear to be reluctant

to use the water? I may add, however, as a set off to this circumstance, if well authenticated, that sickness is almost unknown among these healthy and robust French fisherman, that their children, exceedingly numerous, seem altogether exempt from the fatal diseases of childhood elsewhere. And, strange to say, there are no medical men on the island.

The immense swampy plain, extending from South West Point to Heath Point Lighthouse, parallel to the southern shore, also formed, perhaps, a chain of lakes at one time. It is about eighty miles long by one-and-a-half to two-and-a-half broad; its edge did not display any marl along the strand, but although now treeless I remarked in the peaty soil the roots of trees larger than you meet along the sea margin at present. It may be on an average six feet above the waters of the gulf at high tide. The moss on the surface is beautifully green in color, and at a short distance gives it the appearance of rich meadow land. It could easily be drained, and I doubt not will become valuable at some future time.

Deep sea fishing is not pursued there. Harbors for larger boats than the inhabitants use are much needed. If means were adopted to enable salmon, white trout and eels to get beyond the perpendicular falls close to the outlets of some of the northern streams, the angling capabilities of Anticosti would be considerably increased. In all the rivers, as far as my examination goes, there are numbers of roots of trees, as well as fallen timber, which would prove almost insurmountable obstacles to the best angler that ever cast a fly for salmon or trout.

As a field for Botanical researches Anticosti presents one of the most interesting on the continent, from the large number of strange specimens it contains. I suspect many of them were introduced by way of Labrador or Newfoundland. I was informed that Professor Macoun had recognized several Arctic forms there; but, I presume, his time was limited, for he examined only a small portion of the south-west shore. And this part struck me as the least interesting botanizing ground. In a swamp near the burial place at English Bay, I noticed an exquisite little pink heath.* Bushy, a complete mass of blossoms, which reminded me of the white heather of our

* I am not certain, however, regarding its classification.

Munster Hills more than any other plant I recalled to memory. It may be rare, for it was not seen elsewhere on the island.

Although not a botanist, I may claim at least that I have always been a fern collector or admirer. In Jamaica, in the West Indies, Newcastle, where I was quartered, and the Blue Mountain Range, where it is situated, contain, according to Hooker and others, no less than five hundred species of tropical or sub-tropical productions. When I arrived at Anticosti and noted the humidity and foggy atmosphere, the ravines and streams of fresh water shaded by the stunted pines, so characteristic of the coast line, I concluded it would prove remarkably productive in northern ferns. I was, however, disappointed, nothing but such as the coarse bracken and commoner kinds were obtained.

The Pitcher Plant frequently covers patches in the swampy places. On the sandy soil, above high water mark, between English Bay and the cliff called North Point, I noticed a wild pea, which grows to a considerable height, and is quite robust. The inhabitants use it as winter fodder for the few horses and cattle they possess, and animals greatly relish it. It may be worth while to ascertain whether it would flourish elsewhere. A small strip was said to produce more food than an acre of meadow land. If this be true, it may be a valuable crop. It may require the salt spray, however, for its full development. The wild strawberry, larger than any in Quebec or Ontario, seems common where fishing stations formerly existed, as also the raspberry and currant—red and black; two bushes of the white species were seen. All are apparently indigenous. Though confined to the clearings I do not think they could have been introduced. Near Heath Point Lighthouse, in addition to the cranberry, blueberry and crowberry, I remarked a fruit on the moss or swamp bearing some resemblance to a yellow strawberry. I was informed it was used as a preserve when ripe or fit for gathering; it presents a reddish color. I do not remember the local name.

Of the localities for Anticosti fossils Richardson's report on the Field Geology of the island coast furnish on the whole a very accurate description. True, he failed to notice the Post-pliocene deposits, but when we reflect on the difficulty of ascertaining the heights of cliffs, the dip of the beds and their

thickness, we may not be much surprised at a single oversight on his part. For my part I wonder how he ever accomplished so much in the limited time at his disposal. While I agree with him, that Gamache or Ellis Bay has been carved out of the Niagara beds proper, I doubt that Junction Cliff displays any point of contact between the Cambro-Silurian rocks and those formerly described as the Middle Silurians. I spent three days in examining the beds deposited there, independent of several visits subsequently for the purpose of collecting fossils, but I failed to obtain any confirmation of this. I found it utterly impossible to make any separation of the series at this point. All, or nearly all, the organic remains I obtained there were well defined Niagara. There is a low cliff between this and the West Point Lighthouse, rather shaley at the base, containing only a few fossils of the late Professor E. Billings' Anticosti group. It holds, however, a great many specimens of Hudson River species. I feel inclined to think the upper or almost inaccessible part of this cliff may display the meeting place of both. For my own part I believe Mr. Billings was quite correct when he asserted no division existed, and no break in the chain of life has been noticed as occurring at Anticosti.

I succeeded in extracting from the soft shales a magnificent and well preserved Murchisonia Gigantia, and quite a large collection of Orthidæ, Orthisina, Ambonychea radiata and others, characteristic of the upper Bala beds of Ontario. I placed them on a large flag near the shore. Unfortunately while I was engaged in adding to my collection, a French fisherman came along, and, unnoticed by me, raised up the largest and rarest one to examine it. You may easily fancy the result, it slipped through his clumsy fingers and fell into fragments on the rock below. The interior was hollow, but partly lined with spar or silex. Ellis Bay is one of the best places for organic remains on the island, in addition to Bratrecea, the Paceolus, a yet undetermend organism, may be had there. Although the exterior resembles a coral, the inside is filled with muddy sediment. This I ascertained by breaking up the oval species. It may be noted, the late Professor Billings previously stated it could not belong to the Actinozoæ. Whatever the classification, the beds at Ellis Bay are very fossiliferous, they form the lower division of the Anticosti group. They are remarkable for

containing so many Hudson River species, and I consider they may be looked upon as birds of passage only.

On glancing over the list of specimens collected by the officers of the Canadian Survey, I find Xamerella Ops omitted in the lower subdivision but credited to a succeeding one. It is very numerous and remarkably well preserved in a miniature cliff about six feet high, at the head of the bay near the western horn or entrance. Ascoceras, Beatrecea, Halysites, etc., occur in an upper part at the other side of the harbor near Eagle Cape. When I visited the island, a road, over which I travelled, was in course of construction along the shore from English Bay. The locality can be now easily reached by land.

As you may find in Richardson's report all necessary information regarding the organic remains of the remaining part of the Anticosti group, I need say nothing more on the matter. Between Jupiter River and the South West Point Lighthouse, an interesting section of the higher body may be remarked abounding in Trilobites, Corals and Brachiopods. On the north shore Charleston Point presents numerous Crinoids (Hudson River) and remarkably well preserved Brachiopods. The cliff has a considerable slope near the eastern curve, and many of the layers, thin limestone and shales, can be examined from a platform at some distance above the base. The cliff is only one hundred feet high, an inferior elevation when we consider the abrupt perpendicular rise of others on the northern shore of the island. If you stand on the lake shore, imagine what we call the mountain towering above you, then almost double its height, and you may comprehend the meaning of elevation above the ocean surface of many of the Anticosti rocky wall-like elevations. The gradual ascent of a mountain chain, however steep, fails to impress one as regards its altitude in the same way as the sheer perpendicular height of the canons of Colorado or the bluffs of Anticosti. Soaring considerably above the noisy gull, attending a school of herring or mackerel, and carrying havoc into their ordered lines, you may notice occasionally a small white speck far up in the sky. It poises itself for an instant over a particular spot, then comes a flash as if a white rock had suddenly been dropped from above, then a considerable time after the splash and report you may notice the gannet or gander (Solan goose), Sola Bassana, emerging from the sea with the hooked bill firmly grasping the

morning meal he had provided for his mate and the hungry progeny they recently raised.

The rarest fossils I discovered in the island were in that portion between the last named and Mareld River. One, now in the Redpath Museum, Montreal, belongs to the new genus Cyclocystoides, (Salter and Billings). This extraordinary family seems to be a connecting link between the star-fishes and extinct cystideæ. "The choice lies between them," was the final conclusion of these distinguished palæontologists. Their first impression was that they had undoubted evidence before them of the existence of circular star-fishes. At that time, however, the two-fold nature of many of the palæozoic organic remains was not generally accepted. I had no means of comparing mine with the two described previously; but as it was apparently unknown to Sir Wm. Dawson, I may infer it may be a new species. A star-fish, possessing the peculiarity of subdivided rays, and bearing a resemblance to the Maltese Cross, I unfortunately lost between Indian River and English Bay. A rough sketch of it was taken when I was staying at Macdonald's Cove, which may convey its general appearance. As the plates are not present, it can hardly admit of restoration, a circumstance the more to be regretted, as it differs so widely from all other palæozoic star-fishes figured or described.

Ice Beneath the Soil at Anticosti in Autumn.

During my stay on the island in 1885, a singular circumstance was brought to my notice by a gentleman who was sent from Quebec to replace some telegraph poles that had given way there. He informed me he found a solid ice sheet underlying the soil some six feet below the surface. Now the winter in Anticosti is less severe than in Ontario; cattle from a wrecked vessel have survived a winter's residence unattended and uncared for in the open air. Old residents assured me the frost does not penetrate more than twelve inches even when the ground is unprotected by snow. It may be rash to suppose it represents a survival of the great Ice Age.

FOSSIL PLANTS, HAMILTON, ONTARIO.

Read before the Geological Section, October 23rd, 1892.

BY COL. C. C. GRANT.

[*Supplementary Notes to a Paper read before the Association, October 8th, 1882.*]

Since I read a paper on the above subject I paid sundry visits to places in this neighborhood where these organic remains were originally obtained, and although not successful in obtaining others in better preservation than the ones submitted for examination by the members of our Association, I have a few more which may prove of some little interest to the Section.

From the lower portion of the Clinton beds, above the grey band, I secured fragments of the cord-like fucoid, possessing a striated appearance. This may be allied to, if not identical with, a form appearing in the Medina series. The plant in the latter, it is true, does not usually present the longitudinal lines or fluted aspect; however, in rare instances, I have remarked this peculiarity. The fucoid from the Niagara shale came from the quarry near Mr. Colbeck's. It seems very well marked; however, it may be only the detached branch or branches of a Buthotrephis. Its plant nature can hardly be questioned.

The small Clinton Licrophycus here produced does not come under the head L. Minor. The stem was more flexible and the tuft of branches more closely bunched at an acute angle. The plant at first sight would lead one to suppose it was of a soft succulent nature; this supposition may prove erroneous. Both stem and branches stand out boldly in relief on the surface of the flag, though difficult to reconcile with what I asserted as regards its flexibility. Altogether I think there are three small species or varieties represented in the Clinton beds, and one in the Medina grey band. In a specimen from the former, the main stem throws out a compact tuft, is continued and forms a second one higher up. It appears quite impossible that anything but a plant could have left this impression.

Another Clinton specimen obtained last week from the Medina quarry, near the reservoir, seems undetermined. The same may be said of a few more also from the lower series nearer the city, all of which are submitted for examination.

On a recent visit to Hamilton by Dr. Hall, of Albany, his attention was called to what the late Professor Billings remarks relative to that curious fossil figured in the second volume of the Palæontology of New York. The furrow of mine collected from the Chazy sandstone by Sir Wm. Logan, differs from the one in the Clinton rock. It does not run the whole length as in the latter. You may note while the distinguished palæontologist agrees with Dr. Hall in its classification as a portion of an Alga or Fucoid, he refrains from suggesting an explanation which may be permitted in a mere amateur. Instead of representing the seed pod of the sea plant, may it not have been a bladder-like expansion to keep the Alga afloat? Such are known to exist in the North Pacific at the present time. The Nereocystes Lutkeana, in the vicinity of Sitka, has a stem-like whipcord which terminates in an air vessel.

The Clinton specimens here at Hamilton occur in what I have called the alga bed; where found in other layers, the detached or broken-off bladders, may be imbedded in a higher bed. On one occasion I found six of them on a small piece of shale with a fragment of the stalk seemingly attached to a specimen.

FRAGMENTS OF PALÆOZOIC SEA-FLOORS FROM HAMILTON, ONT., AND ANTICOSTI.

Read before the Geological Section, February 26th, 1892.

BY COL. C. C. GRANT.

Some years ago I forwarded to an old correspondent of mine in Dublin, the late Professor Bailey, a small collection of fossils for the museum attached to the Irish Survey office. The greater portion was obtained near the city of Hamilton. In returning thanks for the donation, he expressed such warm admiration for a few Clinton, or May Hill, sandstone slabs enclosed in the parcel, that, in a subsequent contribution, I presented him with nearly all the like ones in my possession, and hunted up a few others also for his acceptance. "I consider the slabs of far more interest," he remarked, "than any of the single specimens we received from Ontario. One could learn more of the invertebrates, corals, bryozoons, thus accumulated, of the period, than from any number collected singly from beds bearing the very vague term, 'Silurian Series.'" He had never seen any of these instructive and interesting slabs either figured or described. Unfortunately, I have not been able since to replace many of them. I succeeded, however, in getting a few for the late Professor E. Billings and McGill University; as also some fragments for your inspection to-night.

Commencing with the Grey band, there is a thin sandstone bed resting on a slight parting of shale; about a like quantity of the same material overlies it. It was from this layer of the Medina that I obtained, in addition to several plant remains, specimens which enable me to increase the rather meagre list of fossils of the series, as given by Dr. Spencer, by the following unrecorded, I think, as yet: Stromatoporæ, 2; Tentaculites, 2; Athyris, 2, Athyris umbonata, Anticosti (Billings) 1; Fragments Trilobites, 2; Crinoid Stems, 2, both in Clinton also; Zaphrentis, 1, another described; Favosites, 1; small coiled shell, orifice concealed, 1. The latter occurs also in one of the massive layers, with a Stromatopora and an Orthoceras in the Redpath Museum. The fucoid Mr. Walker gave me for Sir

Wm. Dawson come from this horizon. It may prove to be a marsh plant; it differs from any I found, and may be a new species. As is the case generally, the fossils only occur in certain patches through the bed. This I ascertained through experience, and I mention it to guard you against disappointment. The specimens of this shallow water sea-floor in my possession now are exceedingly poor, in indifferent preservation, and their sole recommendation is, they may be considered better to display than nothing at all, to use an Irishism. I have on a previous occasion referred to the absence of organic remains in the red, green or mottled shales, and pointed out that the explanation sometimes offered regarding their being deep sea deposits offered no satisfactory answer, inasmuch as free floating shells must have been interred in the muddy sediment sometimes. For my own part I could never understand why the red Clinton shales, which, perhaps, owed the color to iron, were so fossiliferous, whereas the Medina ones underneath could only display the mere fragment of an alga, which, to the finder seemed doubtful. A red Orthoceras, forwarded to the late Professor Billings, unquestionably came from a gully below the capping of the Medina freestone band. Probably it was washed down from the Clintons overhead, filling up a natural void, and cemented by frost, which, from its position, could not be dissolved at an earlier period. Anyway I do not care to claim the discovery of an Orthoceras from Hamilton, Ont., below our local freestones. When Dr. Jas. Hall, of Albany, recently paid a visit to Hamilton, I asked him why the Medina shales were so barren of organic remains. His explanation coincided precisely with the views Professor Wilkins recorded at a late meeting of our Association. Both arrived at the same conclusion independently.

But why sea-floors? Does not every fossil embedded in rocks, shales, mud or sand, point to the same means of accumulations—the sea bed? Well, no, not exactly. The term is not applicable in many cases to the material or rocks enveloping fossils. Fresh water streams, bays and lakes, may also put in a claim to the contribution, not forgetting the ancient and modern marshes to which tides had or have merely occasional access. But doubtlessly in a general way the objection has considerable force. So I had better here explain that our fragments of sea-floors are merely selected slabs of ancient Palæozoic sea bottoms, thin layers of limestone, sandstone, etc., whose surfaces in nearly every instance were covered, perhaps sud-

denly, by muddy sediments that materially assisted in preserving the organic remains beneath in a somewhat better condition than usual. In my search for fossils in Europe and this continent, from the lower Silurians to the seas of Somersetshire, I have almost invariably found the most likely place to find them was a thin lime or sandy layer enclosed by shale or mud. And it seems quite natural also. Rivers, for example, when flooded, carry off and convey to the sea, large quantities of silt, depositing it over the sea bed. It not only covers dead shells, etc., but entombs living animals, also plants, bryozoons and such things as were unable to escape from its unwelcome advance.

You may excuse me for offering a remark you may deem rather outside the subject of my paper, but since I failed to elicit any satisfactory explanation in the matter, and cannot find it touched upon by others, I may be pardoned for alluding to it. Many, if not all, who have studied corals and coral reef builders, are perhaps inclined to accept Dana's reasons for the exclusion of corals in tropical seas—first, cold extra-tropical currents, secondly, muddy or alluvial shores, emptying of large rivers, for coral polyps require clear sea water, and generally a solid foundation to build upon. Such was not the case with regard to Clinton Favosites, popularly called Honey-comb Coral. I have obtained many from the silt beds *in situ*, viz: stile erect, ten inches in diameter at top, (the latter I underscored), for the term "shale" is frequently applied to far harder layers, and if I use the word "marl," it may express what I intend to convey as regards my meaning to some few, but it would certainly lead to one fact, that however the chemists may differ among themselves, all would unite in one respect, viz., abuse for anyone who borrowed, missapplied or misunderstood even the least of their immediate scientific belongings. Of three specimens of the chainpore coral, Halysites Catenulatus, two were discovered in a soft Clinton mud band. The Alcyonarian coral, Heliolites Interstincta, a Cambro-Silurian of Anticosti, occurs more frequently in the blue shales than in the harder limestone layers. You may see in the well preserved specimen from the island now produced for your examination, there is no point of attachment displayed. So it seems permissable to infer that the Palæozoic polyps were fitted to withstand and overcome conditions which would prove fatal to their modern successors. It is a difficult problem to solve,

but we may leave the matter for wiser heads than ours to settle, while we resume our researches over the elevated sea-floors.

Leaving the grey band of the Medina series, close to the city, under the brow of the mountain, so-called, are a number of quarries, formerly worked for the valuable freestone beds. The base of the Clinton is there well exposed, as a good deal of worthless material for building purposes must be removed before the sandstone is reached. This was carted off or flung down the slope at the base of the elevated plateau. The mounds are noticeable still in many places, though in some cases the grasses have encroached and partly concealed them. Some twenty-five years ago, one had little difficulty in securing fine specimens, when the softer portion of the mud heaps was washed from the surface, and the thin fossiliferous layers were exposed to the weathering process. Now you could certainly have secured better preserved fossil slabs under such conditions than if you obtained them from their places *in situ*. But if you are unable to point out the exact position of the beds, I have ever considered it a serious drawback to the pleasure of collecting. The plan I adopt is this: Whenever practicable I trace the layer to its original place; sometimes the clay resting on it may conceal indications of organic remains, so it may be necessary to put them out on the roof of a shed for a year or two to weather. Some of the Clinton slabs submitted for your inspection underwent a process similar to this. You cannot fail to notice how remarkably well preserved some of the delicate Bryozoons are. I have so recently called attention to the plant-bearing beds of the Clinton and Niagara at a general meeting of our Association, that I think it unnecessary to allude further to this branch of fossil remains. The few specimens since then seen or obtained only strengthen the belief already expressed respecting their nature.

So I propose to request the members of the Geological Section to examine a few fragments of Silurian sea-floors derived from the Rosseaux Creek waterlime beds, Barton, concealed measures of Dr. Spencer, recently exposed in the Marshall quarry, a little above the Albion Mills. A portion of the series now known as our local Barton, may be found to be equivalent to the Waldron, Indiana, Niagara, of Dr. Jas. Hall. On comparing the organic remains they appear identical. The same opinion has also been expressed by my old friend, Mr. Walker, and his son, who has a remarkably fine

collection he showed me a few years ago from this locality of the States. I was impressed also by the close resemblance the Barton fossils bear to the Guelph ones; several are identical. It was claimed by the late Sir Wm. Logan that his Guelph formation was distinct and constituted a well defined and separate zone from the rocks underneath. It is quite true the actual point of contact has not yet been discovered. I believe the groups merged into each other through the slow depression or sinking of the sea bed before the Guelph limestones were gradually deposited; I doubt if any break can be discovered. Trochoceras displanense, Barton, Niagara, (Waldron also) has been lately found by Mr. Townsend, in the Guelph, at Durham, Ont. I believe some of the Murchisoniæ also have their affinities in our shales On palæontological grounds they cannot well be separated. I cannot say what reason United States had for asserting the Guelph formation of Canada was merely the capping of the Niagara. I am disposed to acquiesce in this view. Many of the Silurian sea-floors in Anticosti present the organic remains in excellent preservation. The limestone layers are very thin, generally about one-half to three inches, with slight shaly partings. I retained a small number for personal study, because they displayed, perhaps, internal structure, teeth, hinge line or muscular impressions, with which I was not sufficiently acquainted. Some little time ago I alluded to the discovery on a mountain in Wales, 1200 feet above the sea, of shells still living in Arctic waters. I find the Duke of Argyll, regardless of ridicule, stoutly maintains they were left there by the Noachian deluge—I suppose he imagines they floated about like corks—and as the waters were drawn off and the tops of the hills arose to the surface, what was more natural than settling there just as they are found. That a baker's dozen or so of the clergy should adopt this idea, was not unexpected, but in exultingly pointing to this extraordinary fact which admits of no refutation, they unconsciously endeavor to show mankind existed on earth long before the time recorded in Jewish manuscripts. Taking everything into account, it must be admitted, the churches now display a better knowledge of geological matters than the Venerable Dean Cockburn, of York, who informed us some forty or fifty years ago in his New System of Geology, as quoted by Hugh Miller: "These creatures, Trilobites, (Molluscs) appear to have possessed the power of secreting from

the stone beneath them, a living covering for their backs, and perhaps fed on the same solid material." They must have found the food the Dean supplied them with rather indigestible. And this pillar of the church proceeds: "When the newer Llandeilo slates were deposited some spawn arose above the flags and was warmed into existence. Their successors fed upon a newer deposit, from some deeper volcano (the Wenlock for instance) corresponding to our Niagaras. The learned have classed these shells under the names Terebratula, Orthis, Atrypa, Pecten. They are all much alike, only an experienced eye can detect any difference." Never tell me the Scot is devoid of humour. Hugh Miller, by simply incorporating Dean Cockburn's opinion into one of his works, The Footprints of the Creator, clearly proved he at least had a keen sense of the ludicrous. One is led to imagine His Grace of Argyll may have acquired his knowledge of geological matters from the Dean of York. I cannot show the Section a specimen of the Post-Pilocene sea-floor, referred to by the Duke, but the Museum cases contain a few of the same Pleistocene fossils, from the Leda clay of Anticosti.

MESOZOIC REPTILES: HAVE THEY LIVING REPRESENTATIVES?

Read before the Geological Section, April 22nd, 1892.

BY COL. C. C. GRANT.

I.

In answer to this question, "Decidedly not," was the reply of one of the greatest palæontologists of our age. "Surely, if they had, we must have obtained some remains in proof of their existence. Now, as regards the mythical sea-serpent, I hold that to be merely an optical delusion." Well, it may be so in some instances, but, taking all the evidence into account, are we justified in ignoring what has been urged in the affirmative?

We must not forget how modern naturalists contemptuously dismissed, as unworthy of credit, the dimensions of a cuttle-fish as given by the elder Pliny and others. Instead of exaggerating the size, it has been proved beyond any doubt that specimens of far greater magnitude are living yet in the North Atlantic, as was shown recently by Professor Varril and others. When Chevalier Bunsen, of Berlin, Ambassador to the English Court, clearly pointed out that the city of Memphis, in Egypt, was founded by Menes, pyramids erected and copper mines worked nearly four thousand years before Christ, the great German scholar was looked upon, in church circles, as a dangerous Teuton, who had imbibed the false chronology of the priests of Isis. When a little later the English geologist, Godwin Austin, published a work and adduced positive proof of man's extstence in the valley of the Nile, perhaps thousands of years before a stone of the great pyramid was quarried, (3229 B.C.) he was bitterly assailed for implying any doubt regarding the accepted belief in the truth of Biblical chronology. He called attention to the fact that when Egypt became a portion of the Roman Empire the Romans erected pillar stones to mark the inundation of the Nile; that in the 2000 years which elapsed since then only five feet of silt or mud had been deposited; that pits

sunk at various points close beside them, at considerable depths, displayed broken pottery, rude stone and other implements, manufactured by human beings very little advanced in civilization. Specimens, quite numerous, were discovered between seventy and eighty feet below the base of an adjacent pillar. But previous to the Roman occupation probably the river brought down silt in greater quantity than since. That may be so, although not at all likely; I think we may strike a fair average from the accumulated deposit of the 2000 years. When Boucher de Perthes, about half a century ago, produced flint implements, arrow points, which he discovered at Abbeville, many were so blinded by prejudice as to assert that they were merely natural chips, which accidently assumed the appearance presented, and deceptive indications of antiquity.

I have, for many years, collected all the evidence obtainable respecting the great sea-serpent, or more or less allied sea-monster, because I was not satisfied that Owen and others were fully justified ih rejecting its existence for the reasons adduced. There was, I admit, considerable force in the statement that the misty atmosphere of northern latitudes, coupled with excited fancy, possibly led the Greenland missionary, Egede, to suppose a ship's mast, in the rough state, or a similar object, was the thing he described as a frightful reptile, seen by him in 1734. The assertions of other divines, Græmius and Maclean, were considered as unworthy of credit for a like reason. Such an explanation, however, was not deemed by many quite so satisfactory in the case of *The Dædalus*, whose Captain McQuahæ reported he had seen an immense sea snake on the homeward voyage from India, on the 6th August, 1848. All the officers alleged there could have been no mistake in this instance.

When the famous scientist, Professor Owen, stated that "not a single bone of the great sea snake was to be found in any museum, neither can it be shewn that its body was ever washed ashore," he may not have seen the description of the sea monster found by a fisherman lying dead on the strand of one of the Hebrides only a few years previously. I do not know if any record of its dimensions is still in existence, but I am perfectly satisfied that no conger eel, for instance, was ever known to attain one-half its length; the largest came from the Mediterranean, and never exceeded nine or ten feet, if we can credit the fishermen there.

At the time the French settlers first occupied Quebec, the walrus was seen frequently in the Gulf of St. Lawrence. The tusks are exceedingly durable, but I doubt whether any museum on this continent possesses a specimen from that locality, Laval, perhaps, excepted. One was picked up on the shore of Anticosti several years ago, and, I was informed, was presented to a French clergyman. He may have given it to the Regents of that university, whose valuable collection reflects very great credit on the French inhabitants of the lower Province. It certainly is far ahead of any in Ontario, and the only thing we can urge in explanation is its longer establishment.

II.

Since Owen published his belief in the non-existence of the sea monster, much additional proof on the subject has been obtained. The London (Eng.) Spectator, Dec. 30th, 1874, furnishes us with this statement: "In the Straits of Malacca, the great sea monster, so often declared to be mythical, was seen recently and observed by competent witnesses. On the arrival of the *Nestor* at Shanghai, the master of the ship, John Keiller Webster, and the surgeon, James Anderson, made a statutory declaration before a magistrate that they themselves, passengers and crew, had seen a creature resembling a huge salamander or lizard, of the following dimensions: head, 12 feet; body, from 45 to 50 feet; tail, not less than 150 feet. It was first seen at 10.30 a. m. on the 11th of September, fifteen miles west of the North Sand lighthouse. In the straits the weather was fine, sea smooth, and air perfectly clear. The three saloon passengers, watch, etc., clearly saw it, and observed its movements. It travelled for a long time as fast as the steamer, appearing to paddle itself along by the help of an undulatory motion of its tail in a vertical plane. The Chinese on deck were terribly alarmed, and set up a howl. Both body and tail were marked by alternate bands, black and yellow, the head was immediately connected with the body, there was no indication of a neck. The surgeon states that the longer he observed it the more he was struck with its resemblance to a gigantic salamander or newt. Its back was oval in form, no eyes or fins were seen. It did not spout or blow like a whale. The greater part of the head was not observed, as it was under water." There appears to be no manner of reason for doubting the very express evidence so soberly given, adds the editor in conclusion.

The next account of a different sea monster was given by Captain Drewer, and is chiefly taken from the log-book of the bark *Pauline*. "July 8th, 1875, 5 deg. 13 min. north latitude, 35 deg. west longitude, Cape San Roque, N. E. coast, Brazil, distance twenty miles, at 11 a. m.; weather fine and clear, wind and sea moderate. Perceived black spots on the water, and a whitish pillar some thirty feet above them—breakers as I thought. The pillar fell with a splash, and another arose. They rose and fell alternately in quick succession. A good glass showed me it was a monster sea serpent coiled twice round a sperm whale. The head and tail parts, each about thirty feet long, were acting as levers, twisting irself and victim round with great velocity. They sank out of sight every two minutes, coming revolving to the surface. The struggles of the whale, and two other whales that were nearly frantic with excitement, made the sea in their vicinity like a boiling cauldron. This strange occurrence lasted some fifteen minutes, and finished with the tail portion of the whale being elevated straight in the air, then waving backward and forward, lashing the waters furiously in the death struggle as it went down head foremost." Allowing for the two coils the captain estimated the length at from one hundred and sixty to one hundred and seventy feet, and seven or eight feet in girth. In color much like a conger eel. "It is curious," adds the World newspaper, "that the whale, that lives on the smallest food of any fish, should itself be a meal for another monster." It seems more curious still perhaps to find the sperm whale, whose powerful jaws have frequently crushed a whaler into splinters, thus confounded with the ordinary whalebone whale, a far less formidable mammal. The female sperm is only half the size of the male (about thirty feet only), very little larger than the grampus, but rarely the latter has been known to attain seventy-six feet, if reliance can be place on the statements of our whaling skippers.

The worthy captain mentions that owing to various circumstances which he enumerates, the north-eastern shores of Brazil are but little frequented by ships, etc., either for business or pleasure. "I wrote thus far," he stated, "little thinking that I would ever see the monster again; but at 7 a. m., July 13th, same latitude, some eighty miles east of San Roque, I was astonished to see the same or a similar one. It was throwing its head and about forty feet of its body out of the water in a horizontal position, as it passed on-

ward by the stern of the vessel and disappeared. I was startled shortly after by the cry 'there it is again to leeward.' On looking in the direction indicated we saw the great leviathan grimly watching the ship, with about sixty feet of its body elevated in the air. The occurrence was witnessed by the officers, half of the crew, and myself, and we are ready at any time to testify on oath that we are not in the least mistaken."

Captain Smith, of the steamer *British Princess*, on his arrival at Philadelphia May 14th, 1889, reports that May 4th, latitude 44 deg. longitude 42-40, he saw an enormous sea serpent. He and the fourth mate were standing on the bridge. On looking astern he saw, one hundred yards away, a large black object sticking out of the water in a perpendicular position, like a long spar or buoy. He seized the glasses to make it out more plainly, and saw it was alive. The head resembled in size and shape the top of a beef barrel. The body, though completely submerged, could be plainly made out by the disturbance of the water around it, and three hundred feet away from where the head and neck stood out of the water the monster's tail was beating and lashing the sea into foam. The first officer of the ship adds, that he had been previously a disbeliever in sea-serpent stories.

The instances above enumerated form only a portion of the evidence that can be produced, but an important communication from the Bishop of Adelaide cannot well be ignored. The Australian mail, within the last few months, brought news of the Bishop's discovery of the carcass of a sea serpent at Avoid Point, near Coffin Bay, South Australia. "While riding along the sea beach," he states, "I came across a dead sea serpent about sixty feet in length. It had a head five feet long, like that of an immense snake, with two blow holes on the top, no teeth in the jaws. The body was round, [the dimensions not given, unfortunately,] the tail like that of a whale. Now we may reasonably infer that the monster thus described must have come to the surface to breathe the atmospheric air. So it appears very extraordinary that it should have escaped observation heretofore.

REPORT OF THE BIOLOGICAL SECTION.

SESSION 1891 AND 1892.

Read at the Annual Meeting of the Association, May 12th, 1892.

The meetings of this Section have been held regularly during the past year, and although formal papers were not presented at every meeting, the members have come together and exchanged notes, in this way promoting that good will which is so characteristic of scientific men, as well as advancing the interests of the Association in general, and this Section in particular.

The notable exent in connection with the Section's work was the Annual Field Day of the Association held at Queen Victoria Niagara Falls Park on Saturday, June 13th, when a large number of members of the Section were present, and spent a very enjoyable and profitable time. The place chosen was a rich one for the botanist, and though the time was that which field-botanists call an *off time*, *i. e.*, between the going of the spring flowers and the coming of the summer ones, the field-presses of the weed hunters were brought home well filled. The President, Mr. Alexander, and Mr. Morris had charge of this department, and several plants, not hitherto in our collections, were added thereto. The Section was much indebted to Mr. Cameron, the head gardener of the Park, who is himself an enthusiastic plant collector, for many useful hints as to the locations where certain plants were to be found, and for the personal help he gave in collecting the same. Mr. Cameron is making a collection of all the native plants found in the Park, and has very kindly offered us duplicates to place in the Association cabinet.

At the meeting held on March 4th, 1892, Dr. Mole read a valuable paper on the Origin and Development of the Horse. The paper was made very clear by the numerous illustrations used and the specimens of various parts of the horse's skeleton shown.

The Section had before them a communication from Mr. Adam Brown, enclosing a letter from Lady Blake, calling attention to the Marine Biological Station, proposed to be established in the island

of Jamaica. Lady Blake and her husband, the Governor, are promoting the scheme. The Section, by resolution, approved of the idea.

During the season several hundred of specimens of British plants have been shown at the meetings of the Section, by the President. These plants have been collected and named by Wm. Hussey, Esq., of Salisbury, England, and Master William Rendell, of Whitchurch Canonicorum, Dorsetshire. The examination and comparison of these beautiful specimens has given the members of the Section a great deal of pleasure and information, and the Section feels under great obligation to these friends for their kindness. It is proposed to set apart a distinct portion of our Botanical Cabinet for this collection. About fifty distinct species of Alpine plants, collected by Miss Alexander in the Tyrolese Alps, during the summer of 1891, were also exhibited at one of our meetings.

In addition to these a fine collection of West India Ferns, comprising no less than about one hundred and fifty distinct species, was presented to the Section through Mr. Alexander by Mr. Adam Brown. The names of these beautiful specimens will be given in a subsequent report when they have been classified and the names verified.

We have also had pleasant and instructive seasons with Messrs. Turner, Chapman and Leslie, and their microscopes, revealing thereby to us the marvelous and beautiful which is hidden in the minute things of animal and plant life and structure.

A. E. WALKER, *Chairman.*

THOS. WM. REYNOLDS, M. D., *Secretary.*

A FEW NOTES *RE* THE SEASON OF 1891.

Read before the Biological Section.

BY D. F. H. WILKINS, B. A., BAC. APP. SCI.

Headmaster High School, Beamsville.

The season opened early, after a short mild winter.

Crows were first seen February 6th.

Sugar making was begun March 4th.

A robin (not a resident) was seen March 10th.

Frogs first heard March 23rd.

Growth commenced March 28th.

Bulbs of Adder-Tongue Lily sprouting, and Scarlet-Cap Lichen abundant, at this date.

Hepatica and Spring Beauty in flower April 2nd.

Adder-Tongue Lily in flower April 4th.

Blood Root in flower April 6th.

Red Maple in flower April 12th.

Marsh Marigold in flower April 12th.

Dicentra cucullaria, also D. Canadensis, in flower April 15th.

True Anemone in flower April 16th.

Cuckoo Flower, Skunk's Cabbage and Cursed Crowfoot in flower April 15th.

Red and White Trilliums in flower April 20th.

Sugar Maple in flower April 24th.

Hooded Violet, Beaked Violet, Yellow Violet and Sweet Violet, White Birch and Water Elm, in flower April 24th.

Indian Turnip in flower May 4th.

First Golden Rod *(Solidago Canadensis)* in flower July 20th.

First Aster *(Aster lævis)* in flower July 20th.

Sugar Maples beginning to turn in color September 22nd.

Red Maples beginning to turn September 25th.

Maples in full flush October 10th.

White Oaks turning, also Red Oaks and Scarlet Oaks commencing, October 10th.

Maple leaves falling first November 4th.

The last Golden Rod *(S. Canadensis)* seen in flower, also the last Asters *(A. longifolia, A. pumicens)* November 17th.

Malva sylvestris in waste grounds, also Larkspurs *(Delphinium)* in flower November 27th. (*Note.*—These were growing under the shelter of some pine and fir trees.)

First (very light) frost September 21st.

First heavy frost October 11th.

First (light) snow November 17th.

First heavy snow (six inches depth) November 27th and 28th.

Ground not frozen on December 14th.

NOTES.

1. The dates of the arrivals and departures of the migratory birds, those of the crow and the robin excepted, are not given because not accurately recorded. The arrivals occurred, however, earlier than usual, the departures later.

2. The heavy drouth of May and June, succeeded by equally heavy rains and much evaporation in July and August, produced cool weather, much prolonging the season. The dry and warm weather of October and November served the same purpose.

3. In consequence of this, second crops of strawberries and wild raspberries were gathered, one farmer supplying a store with red raspberries (*Rubus triflorus* and *R. strigosus*) during the months of September and October. Second crops of black raspberries have also been reported.

GENERAL NOTES.

1. *Potentilla anserina* and *Vicia sativa*, now common in certain fields near the lake shore, were, prior to 1867, unknown in this locality. At this time it will be remembered that a third rail was laid on the Great Western Railway track in order to enable the wheat cars from the Western States to pass through to the East. From some of these cars were dropped at some time or other the seeds of these two plants, for the species were seen shortly after the spring of 1867.

2. The common Teazle (*Dipsacus umbellatus*) was introduced into this locality by the Mennonite settlers from Pennsylvania, their ancestors having previously brought the plant from Europe for the purpose, as is well known, of preparing wool for spinning and weaving.

3. The Black Cohosh (*Cimicifuga racemosa*) formerly common in this neighborhood, is now extinct. It is cultivated by several persons in the village of Grimsby and in the adjacent county, being regarded by many as a sovereign remedy for rheumatism.

4. In the Atlantic Monthly for October, 1862, was published an entertaining article by the late Henry D. Thoreau, the famous New England naturalist. The article is entitled "Autumnal Tints," and has been reprinted in a volume of miscellanous essays by the gifted author. While much of the article agrees with what is noticed in Ontario, the present writer, after many years' observations in different parts of the Province, feels that there must be a great discrepancy between some of the facts as given by Mr. Thoreau and the same facts as noted by himself. Thus, according to Thoreau, the red maple is the earliest tree to change the color of the leaves and shows the brightest tints, the average date for the change being September 22nd. The sugar maple does not follow for some two weeks, and is much less brilliant and varied in color. Then follow the elms, hickories and other trees, and finally the scarlet oak in November, showing a wealth of scarlet and crimson unsurpassed except by the red maple. The present writer, however, has noticed that the sugar maple displays the greatest wealth and variety of color, varying from lemon yellow to scarlet, blood-red and crimson; also that it is the earliest to change, its average date being about September 17th in the more northern parts of the Province, and September 24th to 27th in the more southern. The red maple, on the contrary, with a few exceptions, in its native haunts presents a dull red or even a brownish red color, and changes on or about October 2nd. The few exceptions referred to are some trees which show partly green, partly red colors in blotches, probably the most beautiful leaves of all. Again, too, the scarlet oak turns in color about October 6th, and the leaves fall before the end of the month; moreover, they do not present the brilliant red attributed to them by Thoreau. The present writer is not aware of any systematic attempt to ascertain the dates of the change of tint of our more common forest trees nor of any observations regarding the variability of the change. He is not aware whether anything has been published to show that change of color depends upon or does not depend upon soil, dryness of the season or surroundings of the trees. If any thing has been done by any other members of the Association it should be published.

5. The present writer is not aware that the following has ever been made generally known. On the Post-cænozoic clays (Erie and Saugeen clays of our Geological Survey) the pine timber grown is soft and easily workable, while that grown on the Medina clays is hard and brittle. It is the intention of the present writer to prepare a few slips of each for the microscope and to examine them. The most plausible view appears that the larger percentage of silica in the sandy soil has something to do with the state of the wood, but it were safer not to speculate until observations have been made.

NOTES ON BIOLOGICAL SUBJECTS.

Read before the Biological Section of the Hamilton Association, during the Session of 1891-2.

BY WILLIAM YATES, OF HATCHLEY, ONT.

I.

Scarcely a summer passes without offering something singular in the floral or vegetable world; and gardeners and tillers of the soil have many opportunities of detecting and making note of these freaks and deviations from the ordinary routine of plant growth. Several such instances of abnormality occured and were noted by me during the growing season of 1891, to wit:—A peculiar instance of the phenomenon called "Fasciculation," occurred in a garden in the township of Burford. The specimen was found amidst a large group of Sunflowers, *Helianthus annuus*, and what at first sight seemed a *single* head of unusual size, proved on further development to be a combination of *three* heads. The line of juncture was distinctly traceable by the green scales or sepals of thc involucre, and also by the yellow ligulate florets of the ray forcing themselves distinctly into notice amid the florets of the disc, and in lines that bisected the circular outline of the usual sunflower head. This was done as accurately as if the same problem had been propounded to a student of Euclid.

The deviation from the ordinary growth of these flowers suggested the question to my mind whether this was an instance of a partial reverting to the ancestral type of the Helianthus? What would seem to make this supposition a natural one is the fact that a common *wild* form of the Sunflower is the species *divaricatus*, which we have often found growing in the woods not far from here; and florists know that by cutting back side shoots the vigor and bulk substance of many plants and shrubs can be concentrated in a single stem.

I may add that I had some reason to conjecture that the oddity of floral growth, that we have described above, was the

result of an injury or bruise to the plant at an early stage of growth, as about that time the spot where the Helianthus grew was annoyingly trespassed upon and much trampled by a flock of turkeys.

II.

Another eccentricity in one of the wild, weedy growths that spring up so frequently in neglected corners of our fields, occurred last August in a plant of the the tall golden-rod, *Solidago Canadensis.* The stems of these plants are sometimes deformed by a peculiar enlargement or excrescence (balloon shaped). These enlargements are hollow and are almost always found to contain the larva or pupa of an insect, and are probably the result of a puncture by the parent insect.

The unusual circumstance noted this season was that the enlargements were at the very summit of the stem, and were of the shape and size of the egg of a bantam chicken instead of being turbinate in shape. The puncture, if such was the cause, seemed to have been made in the *axil* or point from whence the branches of the panicle divide off. These latter, which are perhaps more properly termed peduncles, were much shortened and seemed to grow at slight distances from each other out of the upper and narrow end of the ovate excrescence. A number of these peculiarities were seen this year and never previously. The other common species of golden-rod, *S. latifolia* and *S. ulmifolia*, have never been noticed to be deformed by those interferences.

As an instances of the imitative principle in vegetable growth, our attention was lately arrested by a form of parasitical development of, I think, the poison ivy *Rhus toxicodendron.* The plant had shed its leaves, therefore we could not take time to identify, but the general outline and form and color of the shrub, as it clung in hideous snake-like contortions of a venomous purple tint, to the tall trunk of a swamp-ash tree, suggested the abhorrent function and malignancy of an enormous *Scolopendra.* The innumerable radicating tendrils typified and suggested the myriad feet of the detested centipede! And the greyish-white bark of the victimized ash tree afforded a background that set off the outline and complexion of the vampire-like encumbrance with wonderful force and perspicuity.

III.

Many traits in the growth of climbing plants exemplify analogous principles and methods to be found in the life and habits of Ophidians. Notice the growth and function of the tendrils of the grape vine. At first straight and tender, but on coming in contact with a neighboring twig a spiral coil is immediately formed around the foreign support, and something similar to muscular contraction is noticeable, and the grip on the support or trellis is as tenacious and crushing as the constriction of the serpent on its prey. Even in the life and growth of the pea vine, or in that of the diminutive parasitic *dodder* whose tendrils, on coming in contact with the succulent stems of the wild balsam or with the soft new shoots of the raspberry, show a willfulness of grip that seems almost crushing and sanguinary, while from the tendrils of the dodder sharp root points pierce the substance of the victimized plant and leech-like imbibe therefrom life-sustaining fluids. Also when climbing plants have grown to the height of their supporting poles, the extension of the climbing stem is for a time continued into vacant space, and its graceful swaying motion when acted upon by a slight breeze, forcibly brings to mind the proceedings of our common snakes when making excursions among bushes and saplings in quest of living prey.

IV.

An incident that occurred in this locality a few years ago demonstrating the noxious qualities of the common purple centipede or thousand legged worm of the North American woods may, perhaps, be fitly recorded here.

A settler, who dwelt in a log house in the midst of his clearing, was appealed to early one morning by the alarming cries of one of his children, a boy nearly four years of age, who had just finished dressing himself. He complained that something was severely hurting the sole of one foot immediately after he had put his boot on. The boot was at once unlaced and removed, and on examination one of the purple centipedes, which appearances indicated had crawled out of the timber logs of the house during the night, was found inside the boot. On examining the child's foot a livid mark the size and form of the odious myriapod was distinctly imprinted on the skin, and remained for a number of hours.

Both the child and the father were well known to me, and I was told of the circumstance at the time of its occurrence.

V.

In the early part of the month of June last I had the pleasure of a jaunt through a district of Ontario entirely new to me, that is, from Elora through Fergus and on north-east to Bellwood, thence through Garafraxa, Eramosa and Erin townships. The weather was superb, and the fields and woods in the exuberance of summer garniture. After leaving the Grand River valley the topography is in marked contrast to the slightly undulating surface of Burford and adjoining townships. In Garafraxa and Erin vast irregularly shaped mounds of sand or fine gravel are of frequent occurrence, and in some hollows large groups of erratic surface boulders attract the notice of every passer by. There are but few swamps, and when such occur a growth of cedar instead of the black ash, elm, and swamp maple of other districts is here a well marked feature. The country is well cultivated and improved, stock keeping and root culture being a prominent line of farming.

A very marked feature of the district was the paucity of bird life. We had just left a region where the woods resounded with the music of the scarlet tanager and the hermit thrush, as well as that of innumerable small warblers, and where the meadows were musical with the notes of the bobolink, oriole, song-sparrow and meadow-lark; yet, in these townships of East Wellington, during two days' travel, we only saw about half a dozen individual birds! one being a shore lark, *one* swallow, *one* pewee flycatcher, *one* grackle and *a crow or two!!* The diminution in the number of birds became obvious after leaving the vicinity of Elora, as about that place there are many deciduous trees among the cedars and other conifers that are still found growing in and south of that locality. We were induced to surmise that the absence of the black ash, soft maple, and swamp elm trees, in the lowlands of these parts of Wellington county, might account for the paucity of the birds which are found in such profusion among that kind of vegetation elsewhere. As is well known, the hosts of summer warblers find sustenance on the insect larvæ that prey upon the foliage of the above-mentioned trees, the leaves of which are much disfigured and corroded every summer by the ravages of caterpillars; hence the warblers and insectivorous

birds generally are a sort of corollary to forest garniture. Apple and fruit orchards are also more sparse northwards from Guelph than is the case in the south-western counties of Ontario, and it is well-known that to a host of birds of the thrush and warbler families, as well as the cuckoos and finches, the orchard is a natural habitation. Even the yellow-finch and the warbling vireos, so ubiquitous in other counties, were here conspicuous by their entire absence. The road-side herbage seemed also to be of a less varied character than that to which we had been accustomed. Even the blue-weed (*Echium vulgare*) which had in such large measure taken possession of waste places and railway embankments in so many places, had only just got a precarious footing here.

The Duke of Argyll remarked on the absence and assumed musical inferiority of the song-birds of North America. It seems to be admitted that our songsters are more shy and elusive than those of Western Europe or Britain. Is it not probable that such a condition of affairs may be attributable in part to the absence of hedges of hawthorn and other berry-bearing shrubs by which fields are all but universally fenced and surrounded, and which form such a conspicuous feature in the British landscape? Our song-birds are in number *legion*, and many of them have exquisitely melodious powers of song, but are only to be seen and heard in the most secluded recesses of forests and swamps; and years of residence and close observation are necessary to gain a familiar acquaintance with them. Food and shelter from hawks and similar predatory enemies are the necessities of existence to these, and it is possible that if the broad bosom of Ontario should ever be marked and adorned by growing fences and tangled thickets (as of the dog-rose and honeysuckle), warblers of many species would come in throngs to sing and enliven our dwelling places.

In the vicinity of Elora several species of plants, new to us and never met with in Brant County by us, were observed, *to wit:* On the sides of the rocky precipices about the river valley at Elora, one of the most interesting species of fern is the Rock brake (*Pteris gracilis or atropurpurea*). In its general aspect this does not much resemble the common ferns, but the fruit dots are borne on veins of the frond near the margin.

In the woods bordering the rocky chasm, *Aspidium acrostichoides* and *Asplenium thalicteroides* were common, and *Adiantum peda-*

tum was abundant in some spots. A species of *veronica*, very much like *Hederifolia*, was also very widely diffused, and the dwarf maple *Acer spicatum* we found very prevalent among rocky debris on the flats of the Irvine and Grand River, where also the dog's bane shrub was common; and we were also shown a rare species of primula (*P. Mistassinaca*), that had been found growing on the river flats, by Col. Clarke, of Elora.

In a cedar swamp bordering the same stream, the large purple cypripedium was just coming in flower, and that peculiar shrub which so frequently puzzles the inexperienced botanist, *i. e.*, the alder leaved buckthorn, (*Rhamnus alnifolia*), was as abundant as it is in some of the bogs of Brant county; although this shrub is classed in Polypetalæ, in this particular species the petals are wanting! and the branches are thornless! We also noticed a variety of Antennaria, nearly like, but not quite, *A. Margaritacea*, or pearly everlasting flower, the difference was in the remarkable angles of the stem and peduncles. In Brant and Oxford counties that pretty adventurer, the Snowy Campion (*Silene inflata*), has only begun to put in an appearance on some of the new railway cuttings, but it is a troublesome weed in the turnip fields about Elora, and although the blue iris (*Iris versicolor*), which so lavishly adorns the boggy spots in Burford and Brantford townships, and the dense growths of the cerulean vervain (*Verbena hastata*), which so attracts the eye in ill-drained hollows in Oxford county—are absent in these parts. A number of less showy interlopers are making good headway as the white melilot (*Melilotus alba*), which is becoming abundent in many places on the railway track about Fergus, and occasionally, that capparid, from the gravelly Lake Erie shore (*Polanisia graveolens*), and also the tufted vetch (*Vicium cracca*), and we were also informed that the yellow ox-eye daisy, (*Rudbeckia hirta*), was, in many places, proving troublesome.

Whilst rambling late in the afternoon with a friend along the wooded banks of the Grand River, below Elora, our attention was called to the continuous (with slight intermissions) song of a scarlet tanager. The bird was perched on the very highest branch of a tall maple tree, and, singular to relate, that was the only branch on the tree that was destitute of leaves; the singer kept turning slightly from side to side, with his glistening red breast facing the declining sun, as if showing off, with fuller effect, the gorgeous radiance of his

plumage. We have noticed the same proceeding from the top of decaying trees by the same bird in Burford township. The blue bird also seems to have an æsthetic taste as regards colors, for we have several times found its nest with the lining interwoven with the brilliant blue feathers of the owner's wing. One may here remark that the brilliant ruby tints of the tanager's plumage seem to be like dove's neck lustres, very superficial, and like the peach bloom on the human countenance, a sign of high health and condition, and rarely preserved in cage confinement, in fact, a friend who had several tame tanagers tells me that in the second or third month his birds became of a bronze color.

REPORT OF THE PHILOLOGICAL SECTION.

Since its previous report to the Association the Section has held eight meetings, at which papers were read as follows:

May 28th.—"Peculiarities in Hebrew Grammar," as seen by a student accustomed to an Aryan language. J. F. McLaughlin, B. A.

September 17th.—"Metaphysical Theories on the Origin and Development of Language." S. A. Morgan, B. A.

November 19th.—"Phonetic Spelling." C. R. McCullough.

December 17th.—"The Versification of Chaucer's 'Canterbury Tales,'" with especial reference to the "Prologue." Chas. Robertson, M. A.

February 18th.—"The Supposed Etymological Value of Silent Letters," based on the words occurring in Skeat's Etymological Dictionary from from A to G. A. W. Stratton, B. A.

March 16th.—"Two Proposed World Languages," "Lingo Internacia" and "Anglo-Franca." H. P. Bonny.

April 27th.—"A Simplified Alphabet for the Deaf and Dumb." C. R. McCullough.

"A Revised Spelling," a plea for consistency with the slightest possible change. James Ferres.

The meeting of October 15th was devoted to a discussion of Mr. Morgan's paper, and on January 21st, owing to the absence of several members because of illness, no formal meeting was held.

Less work has been done during the past year than had been expected, partly because of the little time at the disposal of most of the members, but chiefly owing to the lack of suitable books of reference, which, while they are of little interest to the general reader, are indispensable to the student.

Reference must also be made to the heavy loss sustained by the Section in the death of its late chairman, Mr. Charles Robertson, whose interest in the work was unceasing, while his scholarship was probably unequalled in the city.

A. W. STRATTON, *Secretary.*

H. P. BONNY, *Chairman.*

METAPHYSICAL THEORIES ON THE ORIGIN AND DEVELOPMENT OF LANGUAGE.

Read before the Philological Section September 17th, 1892,

BY S. A. MORGAN, B. A.

It is no doubt evident to us all, that any principles we deduce concerning the origin and the nature of a primitive language must necessarily be of a theoretical character. When, however, we consider that the faculty of language, *i. e.*, the power of symbolically communicating our ideas by means of articulate sounds, is dependent on the possession by the individual of certain intellectual and physical functions, and must therefore follow their operations; and when we further consider that science enables us to investigate both the nature of these necessary functions and their order of development, we are led to believe that any logical theories we may deduce in such an investigation will not only prove of interest in themselves, but will also tend to furnish some explanation of the variations in form and grammatical structure to be found in existing languages.

The few thoughts I shall offer in this paper may be arranged under the following heads:

(1). Definition of Language.
(2). Existing theories on the origin of Language.
(3). Offices of Language.
(4). Conditions of Language.
(5). Nature of first elements.
(6). Processes of development.

DEFINITION OF LANGUAGE.

All creatures, whether men or animals that possess the gregarious instinct, or tend to live in herds, being bound together by a common feeling, may be supposed to desire and seek after some means of communication. This instinctive desire, aided and developed by experience, has produced in man two forms of thought communication.

We all no doubt have seen that it is possible, by noting the

variations in the tones of the cries of animals and man, or by observing the changes in their features and forms of gesture, not only to know what may be the dominant feeling at the time, but also to form an estimate of the character and disposition of the individual. Taken in its most extended meaning, language might include any such signs by which one intelligence is enabled to interpret the mental modes of another; and this form of thought or rather feeling expression is in fact often spoken of as absolute natural language.

In these cases, however, it will be observed that this visible element or sign, by means of which is formed an estimate of the present mental state, is not in any exact sense a representative symbol of the invisible spiritual mood. It is in fact an essential result of the latter which experience has taught us to associate with it as an ever present accompaniment. But beyond this there is another aspect in the communication of ideas, wherein the sign or symbolic element cannot be said to have any necessary connection with the communicated idea, but is simply an arbitrary or conventional sign for the same.

As an illustration of this distinction, we may suppose that (leaving out of consideration national peculiarities) there would be an equal softening of the eye accompanying the 'zōe mou sas agapō' of the Greek, or the 'Ich liebe dich' of the German, to that noticed in the like confession of our Saxon youth. In each of these, however, we find a wide difference in the conventional elements.

An explanation of these two forms of language may be found in a consideration of the nature of knowledge.

Feeling and thought are the primary or ultimate elements of knowledge. Feeling being a 'mental affection' resulting from changes in the physical organism, and, in so far as it is pleasant or painful, 'impelling to organic action,' it becomes evident that these organic movements will furnish an index to the accompanying mental state.

Thought, on the other hand, being the 'apprehension of relations' and objective in its nature, will lack these outward physical expressions. It will thus require other means of communication, which, for the same reason, must be of a conventional form. The one then may be said to be the language of feeling, the other the language of thought.

Another distinction must be made between the natural signs of articulate speech and the artificial signs of writing, etc. But spoken language being evidently prior to written, a fact which history herself teaches, and the language of physical expression, although an earlier form, admitting of no definite treatment, on account of its subjective and individual character, it necessarily follows that any investigation into primitive language must concern itself with the second of these forms. We shall, therefore, in this paper understand by language the representation of mental modes or ideas by means of conventional articulate sounds.

EXAMINATION OF EXISTING THEORIES.

The existing theories on the origin of language may be divided into the following classes:

1. The theory that man at his creation was endowed with a perfect language, which, as his knowledge grew through experience, he was enabled to apply for the purpose of fixing his acquired knowledge. This theory supposes that language may precede thought and exist without it. Experience teaches us that the very opposite to this is the case; for when thought is destroyed language must cease, whilst on the other hand, when the power of speech has been lost, thought may proceed by means of other signs. Moreover, granting the possession by the first man of such a language, his words would be to him but meaningless cries, and the formation of language proper would still remain to be worked out.

2. The second view, which goes to the opposite extreme, supposes language to be a human invention, adopted by mutual compact for the convenience of man. Such a view must err, however, in the fact that the ability to invent and adopt implies that the race had made considerable advancement, whereas, as will be seen later, thought can make no advance without some form of thought representation. Moreover, the very fact of a mutual compact implies the possession of some form of thought communication.

3. A third view looks upon language neither as a ready made gift, nor as a human invention in the strict sense of the word, but rather as a conscious growth accompanying and dependent on mental development. In other words, that the gift of intelligence implies a two-fold power, power of thought and power of thought expression. This theory, which seems the only one void of contra-

diction, is the one we shall accept and attempt to enlarge upon in the present paper.

OFFICES OF LANGUAGE.

Four distinct functions are set forth as belonging to language: (1) to preserve thought; (2) to analyze thought; (3) to facilitate thought; (4) to communicate thought. It must appear evident, and will be made even more clear, when we come to consider the psychological conditions of speech, that to suppose any of the first three to have been motives in its production would give an appearance of mechanical design to the origin of language wholly at variance with its physical nature and the mental conditions of the primitive race; since they would imply the exercise of the reasoning powers. But we shall there see that these must make use of symbolic representation in their very development. The last of these motives, however, being but an instinctive desire, implies but the lower stages of mental growth, which stages are not dependent on representation for their operations. But we shall here offer a theory somewhat at variance with that usually accepted. We hold that the motive power underlying the origin of language was no more a desire to communicate our own thoughts to others, than it was a desire on their part to interpret properly the thoughts and feelings of fellow-beings in whom they took an interest. As the reasons upon which this theory must rest will come up later; we defer its further consideration till that time.

CONDITION OF LANGUAGE.

It has been seen that the office of language is symbolic or representative. The elements of language, when used as such, are not in themselves real objects of attention, but representative symbols of objects of past experience. Thus the development of speech in the primitive race will imply the possession by them of the symbolic power or faculty with whatever other intellectual development appertains thereto. This consideration will necessitate a brief mention of the mental powers and their order of development.

The intellectual faculties—faculties of knowledge—are divided into three general classes:

1. Those connected with the acquisition of knowledge, including (a) sensation and (b) perception.

2. Those connected with the representation of knowledge, including (a) phantasy, (b) memory and (c) imagination.

3. Those connected with the elaboration of knowledge, including (a) conception, (b) judgment, (c) reasoning.

Sensations may be described as mental modes or affections resulting from the application of external stimuli to some part of the physical organism.

They are the primary elements of conscious life and of all knowledge. But being simply an affective or subjective state sensation does not in itself constitute knowledge. While however sensation does not constitute knowledge, it is seen to contain an element of knowledge; since in sensation there is a tendency to refer the subjective state to some non-subjective cause, which is thus brought into relation with the feeling self.

Perception, on the other hand, differs from sensation in being a constructive as well as an acquisitive faculty; for in this process the 'vague data of sensation' are first differentiated and recognized as belonging to different senses. Secondly, they are supposed to be at a distance from us, or given a position in time and space. Thirdly, they are united into a group, and supposed to have an existence independent of the perceiving mind.

These two faculties will give us a certain form of knowledge concerning present objects, brought into relation with the knowing self. But they will not in themselves lead to the formation of word signs; since they imply an ever present object on which the attention is fixed.

The interaction of these two faculties however will lead to an additional result. Although sensations are but vague sensuous affections, as states of pleasure, or pain they powerfully arouse the attention and direct it in search of an external cause. Perception of the non-subjective cause of the sensation having taken place, this feeling of pleasure or pain at once creates an interest in the external object. This done, there takes place what is known as the "transference of feeling" from the knowing mind to the known object. The sweetness is in the sugar not in my consciousness. The mind in this way looking upon the perceived object as a symbol of the subjective sensation, will have taken its first step toward mental representation. Word signs, however, differ from these in the fact that the association existing between the sign and

the idea is in no way real or necessary. This fact will imply the introduction of still higher forms of mental growth.

This higher form of representation arises after the following manner. The mind now being able to obtain a definite perception of present objects, the accompanying subjective states become fixed modifications of the knowing self, and as such liable to recur in consciousness without the stimulus of the external object. In the first stage, which is known as phantasy, these ideal images, although arising without external stimuli, are supposed to indicate such a presence. A marked peculiarity of these ideal sensations, however, is their difference of degree, as well as their difference of origin. The process of attention working on these differences enables the mind to distinguish the ideal from the real. The mental activity now being able to distinguish ideal feelings as such, is further enabled through identity of modification to recognize the ideal state as having formerly occurred in consciousness. This aspect of the representative faculty is known as memory.

But attention now being able to fix itself on ideal sensations as such, acquires the ability to separate the qualities of an object in their natural state, and to combine them in new and arbitrary forms. This stage, which is known as imagination, would at once enable the mind to form the arbitrary associations seen in word signs.

The higher forms of knowledge must now be considered. The elaboration of knowledge takes place when the process of attention is able to bring any of its individual percepts together and establish a relation between them. Since, however, it is impossible for the mind to fix itself on two objects of immediate knowledge at one and the same time, it becomes evident that symbolic representation is not only possible but necessary before these higher forms of thought are reached.

It thus appears to have been on no unphilosophic ground that memory was represented by the ancients as mother of the muses; since she is not only a necessary condition of power of speech, the *sine qua non* of all progress, but also the forerunner of that imaginative faculty, by which have been produced the various art forms of use and beauty on which the highest skill and taste have been exercised.

Having now considered the various steps in the development of mind up to that stage where the creation of symbols seems pos-

sible, another important question remains to be answered. Though the primitive man may possess intellectual powers suitable for such a task, can we give any reason why this privilege will be embraced? Can we furnish any motive or end for the origin of symbolization?

Under pleasure and pain may be summed up all the motives or ends of action. These being but two aspects of our feeling states, it follows that the discovery of a motive will demand a consideration of the development of mind on the feeling side.

We have already noticed above that our states of feeling naturally fall into two broad classes. The sensation, as an affective state, produces pleasure or pain. This is sometimes spoken of as the primary form of feeling, being consequent on physical changes. We also noticed, however, that by the transference of feeling higher forms of emotional growth might be attained. Let us inquire then whether in these two classes (sensations and intellectual emotions) there exists a motive for the representation of our ideas.

It has been a prevailing idea that the desire for speech arose from the necessity of seeking aid to satisfy our bodily wants, such as food, help in distress, protection, etc. Though these desires may imply some emotional growth, you will see that they point to the sensuous element as a motive, an hypothesis which we cannot accept. We affirm and shall attempt to show that the motive lay in the development of the emotions rather than in sensuous feeling.

In order that we may be the better able to judge the respective claims of these two ends, we shall lay down what appear to us the necessary laws governing the motive or end, naming them as follows:

1. The Law of Sufficient Motive.
2. The Law of Frequent Recurrence.
3. The Law of Adequate Means.

By the law of sufficient motive is meant that, since language is a means of communication between individuals, there must have existed a mutual desire between the person communicating and the person interpreting the thought. It was to this we referred when we affirmed above that language did not come solely from the desire to communicate our thoughts to others.

The law of frequent recurrence affirms the principle that the motive must have been sufficiently frequent to remove any possibility

of the loss of past steps in the symbolizing of thought through lack of having them fixed in memory by repetition.

The law of adequate means implies that the motive must be provided with such external accompaniments as will supply suitable means or characters for the symbolizing of the idea.

Examining the claims of sensuous feelings by these standards, we shall find :

1. That being individual and anti-social, they violate the law of sufficient motive.

2. That if the circumstances of the primitive races were such as to cause a sufficiently frequent recurrence of these bodily wants, it would be impossible for such a people long to maintain existence against such circumstances.

3. Being confined to single organs they do not cause that diffusion of feeling necessary to idea interpretation.

Passing to a consideration of intellectual feelings, we find :

1. Since they imply a universal interest in the external, they are social in their nature and therefore furnish a sufficient motive.

2. Being accompanied with a 'wave of excitement' which spreads over the whole organism and leads to bodily movement, they consequently supply adequate means of symbolization. The fact that they 'arise more slowly and subside more gradually' than sensuous feeling is another cause for the same.

3. Nothing, I think, need be said of the law of frequent recurrence when we consider the effect of a wide world of undiscovered relations on the void but plastic mind.

And now two further questions naturally present themselves to to the mind : 1st. What objects in nature likely awakened these emotional states in primitive man ? 2nd. What symbols were likely made use of for their representation ? These two questions we shall now consider.

THE FACTS OF KNOWLEDGE.

Having seen that language arose from an intellectual source, it will follow that such objects as are likely to awaken intellectual activity would be the first to be represented symbolically. These we affirm to have been acting things, or objects of perception in a state of motion. This is proven both by experience and by reason ; by experience through observation of the first signs of attention in children and in savage races, in both of which loud noises, bright

and flashing lights, swinging and sounding bodies seem most suitable for arousing attention; by reason, since philosophy teaches us that every affective state is but the result of impressions on the senses from some moving body. We may thus suppose that in primitive man the more marked forms of motion would be necessary to impress the unplastic mind of such a state.

SYMBOLS OF KNOWLEDGE.

We saw in our consideration of the sufficient means of representation, that the emotions are accompanied with 'waves of excitement,' which spread over the organism, resulting, on the one hand in certain impulsive gestures, and on the other in the utterance of certain sounds. One or both of these would likely be employed. But the first being so much less subject to conscious control, while supplying a suitable symbol for the internal state, would naturally give way to the second for purposes of arbitrary association.

But it is evident that that these primitive sounds would be to a high degree impulsive, and for that reason, and further because in them the 'thought' element would be as yet but faintly apprehended, we may suppose that at this stage there would be an excess of the 'sound' element. Again, because they were long and for the most part imitative, they would possess the musical element as seen at the close of such sounds. Summing up, we may affirm of our first words: (1) They were impulsive and imitative. (2) They were long or polysyllabic. (3) Equivalent to whole sentences.

We now see that our first perceptions give but vague ideas of objects possessing emotional interest, consisting of acting things; and that to denote these we would make use of certain long sounds as symbols of both the object and its interest. These would consequently form one primary class. Such a perception however contains two elements, object and interest, and attention being aroused would lead to their division in the mind. Thus our primary class will give rise to two, viz: object class and interest class. The attention, now passing from the object to its interest, or activity, would lead to a further division of these activities into, accidental or molar activity on the one hand, giving rise to the verb; and essential or qualitative activity on the other, giving rise to the adjective. The whip would equal the striking thing; the sugar the sweetening thing. This would have given rise to our three principal

parts of speech, noun, adjective and verb. And as these form the three essential parts of speech—the others being but conveniences of language,—we may suppose that they will show the earliest forms of grammatical development.

It was seen that attention, fixing itself on the vague and primary elements of knowledge, soon enabled the mind to classify them into the three above classes. But this attention, now bringing these classes into relation with one another, would lead to a further discovery of new relations, and a consequent desire of their representation. By what means was this to be effected? Existing languages show two methods for effecting this. 1st, by varying the form of the word whose idea is modified; 2nd, by position and symbolic relational words. The second of these methods would evidently be impossible at this stage; since all words would contain the sensuous element to such a degree that the mind would not be capable of that freedom of thought necessary to the use of symbolic words. Granting then that inflection is the primitive method of noting modifications, from what source did it take its rise?

We have seen that the general character of our primitive word was length of sound and vague intellectual reference. In this superfluous sound attached to the word would be found a ready means for the representation of these new relations. Any familiar word being often used in a certain relation, and having its final superfluous sound used for such a purpose, would soon by analogy set a type for all kindred words when used in a like relation. A strong proof in support of this theory is to be found in the fact that inflections always contain a musical element. For a marked characteristic of all inarticulate cries is that they generally end with a somewhat musical tone.

But at this point another result must be considered. We have noticed that the first words were long and intellectually vague, but that the elaborative faculties being exercised on these vague elements, would bring about an enlargement of their intellectual import, and an increased definiteness in the idea itself. But it is evident that the mind, fixing itself on the intellectual import of the sound, would, on the principle of undivided attention, decrease the flow of energy in the direction of the physical sound. This fact would at once produce a tendency to shorten these long sounds. In other words they would tend to become monosyllabic. Thus in

cases where this shortening had taken place before the power of noting relations had been properly developed, other means of representing them would be sought. But as at this early stage the physical element would still be comparatively strong, the musical element would lead to the adoption of internal change or vowel gradation as an additional method.

Since, however, it is a universal supposition that inflections arose from another source, the relative claims of the two theories must now be considered. The prevailing theory has been that, since imagination and conception in their development produces the tendency of dropping from the mind the accidental qualities of an object of thought, and as this tendency enlarged will produce pure symbolic words, inflections may have had their origin by the addition of these to the word. That the former view, however, is more consistent must appear from the following reasoning:

1. The latter view supposes that the noting of relations was postponed until such intellectual propress had been made as would enable pure symbolization to take place. The history of symbolic words, however, shows them to be the product of an advanced state of thought.

2. The musical element in inflection points to its primitive nature as opposed to a symbolic origin.

3. All late developments, the result of linguistic revolutions are marked by analytic means, and never make use of flection, which fact would imply that flection was a characteristic of early developments alone.

4. Our view of the origin of flectional endings and internal change would be strengthened, if it were found that people whose early development showed a marked progress on the objective side made use for the most part of flectional endings.

For the *objective* mind directing its flow of energy toward the external matter would at once acquire great discriminating power. It would be intellectual, critical, an examiner of external nature. Such a mind would early require verbal distinctions to accompany this discriminating power, and would thus overtake these decaying final sounds and retain them for such a purpose. But the *subjective* mind, looking only within, is emotional, figurative and non-scientific, and thus lacking discriminating power, would be late in noting external relations, and must consequently make use of internal change.

Such a condition is found in the primitive Aryan languages as compared with those of the Semitic group. The first people being the critics, the natural philosophers and the explorers of ancient times, also make use of flectional endings. The latter being the egoistic, emotional and monotheistic races of antiquity are likewise found to use this secondary means.

We shall now conclude with a short note on what might seem an objection to the view that language arose from emotional development. It might be supposed that, since the inarticulate cries of animals are frequently indicative of pain, the sensuous element would furnish a more natural motive. But an investigation of the principles of emotional expression in the lower animals will show that these cries were also used for the purpose of attracting attention, especially between the sexes, and consequently would be associated with the highest forms of pleasure. It may be further noted, that it is in this form they possess the musical element, which has been seen to form and element in inflection. Thus everything seems to point to a natural and emotional primitive growth as the origin of both language and inflection.

A PHONETIC ALPHABET FOR DEAF MUTES.

Read before the Philological Section, April 27th, 1892.

BY C. R. M'CULLOUGH.

Nearly eighteen months ago the thought occurred to me that an adaptation of the phonographic characters invented by Mr. Isaac Pitman, of Bath, England, to the fingers, would prove an easy and interesting method in the instruction of my classes in phonetic shorthand. I accordingly set to work and found the experiment successful, the members of my classes reading the words spelt on my fingers with ease and accuracy. This led me to the consideration of the question, 'Why cannot this scheme be extended to assist the deaf and dumb?' Mr. A. W. Stratton, B. A., the secretary of the Association, to whom I mentioned the proposed method, requested me to present the matter before this section, which I do in the hope that merits and demerits may receive consideration and criticism.

In the sixteenth century Jerome Cardan, naturalist, philosopher, mathematician and physician, discovered the theoretical principle on which is based the education of the deaf-mute. "Writing," said he, "is associated with speech, and speech with thought; but written characters and ideas may be connected together without the intervention of sounds." This being true, what need is there for a phonetic alphabet in deaf-mute education? To this the answer may be made that though the deaf cannot hear, they can appreciate consistency, economy and speed. If a phonetic scheme cannot present to the mind of the deaf the sensation and appreciation of sound, it certainly will not offer those orthographical hindrances which our present unsystematic and difficult spelling places in the way.

The scheme advanced will, I believe, enable the operator to communicate his thoughts with one-fourth less labor than at the present time. This is to be accounted for by the fact that a phonetic system of spelling is nearly twenty-five per cent. shorter than the nomic or customary method.

Dumbness, in a large number of cases, is the natural consequence of deafness. To this class of persons, possessed as they are of the organs of speech, which need only training and exercise, a phonetic system of language representation would prove of great value. The ear is tutor to the tongue; render the ear incapable of performing its office and some substitute must be found to carry on the work of instruction. The discovery of *Articulation* introduced this class to spoken language, and it appears to me that an analysis of spoken language, easily indicated on hand and page, should prove of incalculable benefit to the practitioner.

In reference to the analysis I propose, the objection may be raised that the analysis of thirty-six sounds employed in phonetic shorthand is not sufficiently minute, in short, that a spelling based upon this classification might better be termed consistent than purely phonetic. The answer may be made that the refining process might be extended almost indefinitely, but for the average ear the analysis mentioned will prove ample. A reference to "Pronunciation," in my paper on "The Spelling Reform," in a former part of this journal, may be made by those interested in the subject of practical analysis. The thirty-six sounds analysis has, at any rate, some fifty years of usefulness to recommend it, and has proved equal to the demands made upon it, as can be seen in the practice of phonography.

The wide and increasing diffusion of a knowledge of phonetic shorthand, the growing importance of the subject, and the improvement in primary education along phonetic lines, as seen in the introduction of the "phonic method" into our common schools, must bring to our minds the belief that a new era is in store for language representation, in other words, that English will in due time take on a phonetic dress. If the manual herein presented shall have done nothing more than anticipate that event, it will perhaps have contributed in some degree to the cause of usefulness and advancement.

There are to-day hundreds of thousands of persons throughout the English-speaking world who are familiar with the analysis I have employed; ninety per cent. of these are acquainted with Pitmanic shorthand. These, under the plan promoted, could be brought into touch with the deaf and dumb with so little trouble as to be practically insignificant. Phonographers could learn the handed manual in fifteen minutes' time, for the simple reason that the symbols

employed in shorthand writing find their exact representatives in the characters described by the fingers of the deaf and dumb.

If great progress has been made in primary education through the employment of the phonic method of instruction, and a large portion of the child's time has been saved to him, over the old method, why should not the same principle, substituting the hand for the tongue, the eye for the ear, when employed in deaf-mute instruction render the acquisition of knowledge more readily accessible to the silent student?

By careful training and practice the deaf-mute is able to read the lips of a deliberate speaker, or even of his non-speaking brothers. This is, however, a slow process, and requires considerable care on the part of the speaker and much acuteness on the part of the student to obtain anything like satisfactory results. When we consider that slight variations in lip positions for the different sounds, variations which, let us remember, become more indistinct as speech analysis proceeds, it will be seen that the labor of distinguishing the positions must be very great. Give him, however, a manual in sympathy with the lips, and approximately correct, and the labor is greatly diminished. I say approximately—throw away the neutrals, retain the principals.

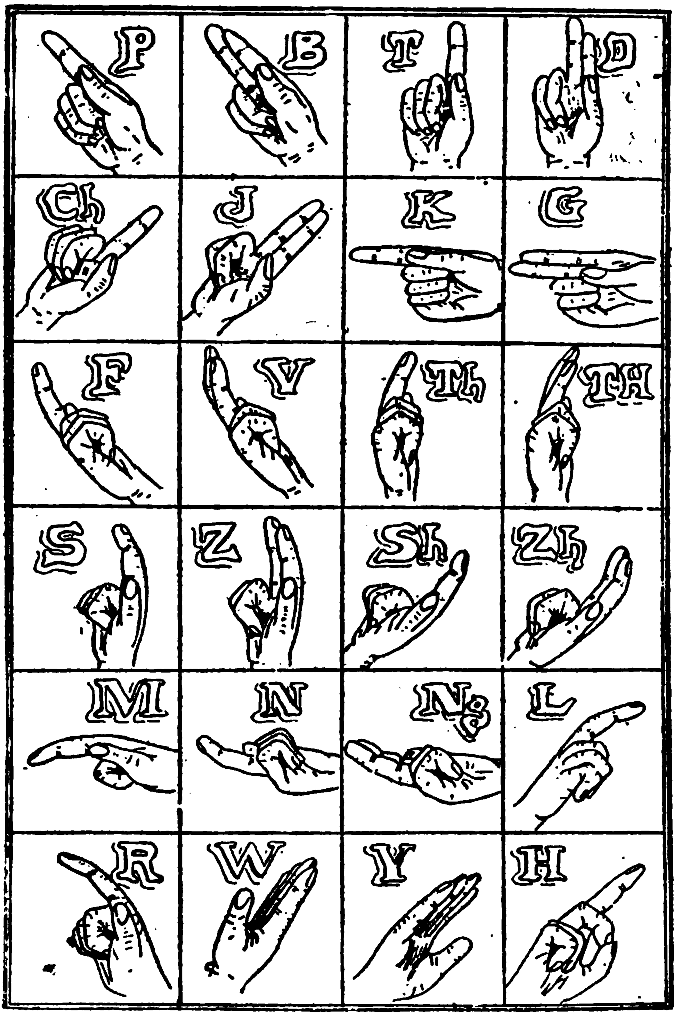
As regards the man who has been born deaf, and who has never learned to use his vocal organs—he, with the man whose hearing has become destroyed, has no guide to assist him in the utterance of sound. The one learns to speak by imitation, the other automatically utters the sounds, or their approximates, heard in earlier life. Both are liable to error and variation in articulation. Let the sounds uttered by the organs of the voice have their counterparts in the characters made by the fingers—let the fingers be so many indexes to vocal positions—and the deaf speaker will have a monitor that will in some degree compensate him for the loss of the hearing faculty.

Anyone familiar with the shorthand alphabet well knows the simplicity of the characters employed to represent the different consonants and vowels. These are arranged in a natural order, in short are scientific. The thin sounds are indicated by thin or light strokes, the thick sounds by thick or heavy strokes. The consonants are arranged for the greater part in pairs, the one being the thick or voiced sound of the other. It is to be remembered that

the phonetic alphabet does not commence in the ordinary way, but is arranged in an orderly manner, the consonants, forming as they do the frame-work of the language, come first, the vowels follow.

THE CONSONANTS.

As seen by the Observer.



The names and values of the consonants are:

EXPLODENTS: P (pee) as in *p*ut; **B** (bee) as in *b*ut; T (tee) as in tell; **D** (dee) as in *d*ell; *Ch* (chay) as in *ch*oke; *J* (jay) as in *j*oke; K (kay) as in *K*ate; **G** (gay) as in *g*ate.

CONTINUANTS: F (ef) as in *f*at; **V** (vee) as in *v*at; Th (ith) as in ba*th*; **TH** (thee) as in ba*th*e; S (es) as in *s*eal; **Z** (zee) as in *z*eal; *Sh* (ish) as in fi*sh*, offi*ci*al, etc.; ***Zh*** (zhee) as in plea*s*ure, u*s*ual, etc.

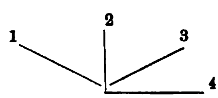
NASALS: M (em) as in *m*eat; N (en) as in *n*eat; **Ng** (ing) as in th*ing*.

LIQUIDS: *L* (el) as in *l*ed; *R* (ar) as in *r*ed.

COALESCENTS: *W* (way) as in *w*ell; *Y* (yea) as in *y*ell.

ASPIRATE: *H* (hay) as in *h*ill.

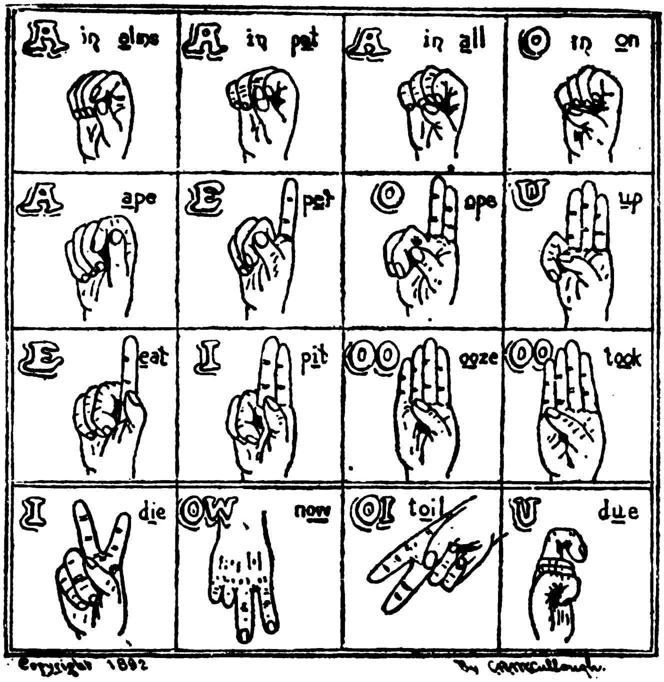
It will be observed that the consonants are written in four positions, and, except R, W, and H, sounds made by the same organ of the voice are written in the same direction. These directions are:



(1) Labials: P, **B**; F, **V**. (2) Dentals: T, **D**; Th, **TH**; S, **Z**. (3) Palatals: *Ch*, ***J***; *Sh*, ***Zh***; *L*, *Y*. (4) Throat: K, **G**; and the Nasals: M, N, **Ng**.

THE VOWELS.

As seen by the Observer.



There are twelve vowels, six long or heavy, six short or light. The long vowels are: (1) A as in *a*lms; (2) A as in *a*le; (3) E as in *ee*l; (4) A as in *a*ll; (5) O as in *o*pe; (6) OO as in f*oo*d. The names of the preceding are: Ah, Eh, EE, Aw, Oh, OO. The first three are made by pressing the tip of the thumb against the top, middle or base of the first finger, according to the vowel required, the last three by pressing the third finger in like manner.

The short vowels are: (1) *a* as in *a*t; (2) *e* as in *e*ll; (3) *i* as in *i*ll; (4) *o* as in *o*n; (5) *u* as in *u*p; (6) *oo* as in f*oo*t. These are made by employing the second and fourth fingers in the same way as with the long vowels. The short vowels' names are: a, e, i, o, u, oo.

For the sake of convenience four diphthongs are introduced: (1) I as in *i*ce; (2) OW as in *ow*l; (3) OI as in *oi*l; (4) U as in d*u*e. These are known as eye, ow, oy, you.

To the practical teacher of the deaf and dumb, there may appear shortcomings in this attempt to present a scheme to assist deaf-mute education. I have had no opportunity of putting into practice the system promoted in this paper other than that mentioned, in connection with stenographic classes in a business college. I shall, therefore, cordially welcome advice and assistance from those engaged in deaf-mute instruction, or from any who may take a general or particular interest in the "children of silence." In conclusion let me say it will afford me pleasure to render any information in my power to those who may desire to give the scheme a careful test.

NOTE.—Since reading my paper before the Philological Section of the Association, and while these proceedings are in the printers' hands, I received, through the kindness of Mr. R. Mathison, Superintendent of the Ontario Institution for the Deaf and Dumb, Belleville, Ont., to whom I wrote briefly outlining my scheme, a copy of a work by Mr. Edmund Lyon, of Rochester, N. Y., entitled "Lyon's Phonetic Manual," published by the American Association to Promote the Teaching of Speech to the Deaf. From a hasty examination of what appears to be a most excellent work, I learn that the system is based on the analysis known as "Visible Speech," the invention of Professor Melville Bell.

REPORT OF THE PHYSICAL SECTION.

Read at the Annual Meeting of the Association.

The Physical Section was organized in November, 1891, and has since met regularly on the second Saturday of each month.

The only papers read so far have been :

December 12th.—"The Phonograph," by J. T. Crawford, B. A.

After the reading of the paper, several tests were made.

Januuary 9th.—" A Brief History of Electrical Discoveries," by J. G. Witton, B. A.

At the other meetings informal discussions have been held. Some difficulty has been experienced in obtaining papers, but that is likely to be overcome as we get together the apparatus we hope to have. We have also to regret the loss of our Secretary, Mr. J. G. Witton, who is now living in Vancouver, B. C. ; his absence has somewhat interfered with the work of the Section, but we hope to see it continued next Fall.

GEO. BLACK,
Chairman.

REPORT OF THE PHILOSOPHICAL SECTION.

Read before the Hamilton Association, May, 1892.

At a meeting held on the 23rd November, 1891, it was resolved to organize a Philosophical Section of the Association, and a chairman and secretary were elected. The remainder of the evening was taken up with a general discussion on the sources and the methods of psychological research.

Since then four meetings of the Section have been held, and the following subjects discussed :

December 5th.—" Psychology," an inquiry into the dual character of the conscious self as subject and as object, by Sanford Evans.

January 16th.—" An Analysis of Experience, Part I," by S. A. Morgan, B. A.

February 20th.—" An Analysis of Experience, Part II," by S. A. Morgan, B. A.

March 19th.—" Sense-Perception," Idealism versus Materialism, by S. B. Sinclair, M. A.

The determination to form a Section in this branch of science was not carried into effect without some misgiving as to the probable result. We feel, however, that the outcome of the experiment thus far warrants us in predicting a useful future awaiting this Section of your Association.

S. A. MORGAN,
Secretary.

S. B. SINCLAIR,
Chairman.

REPORT OF THE PHOTOGRAPHIC SECTION.

Read at the Annual Meeting of the Association.

The Photographic Section beg to submit the following report:

On the evening of April 18th, 1892, a meeting was held in the Museum to form what is now known as the Photographic Section of the Hamilton Association. At that meeting a Chairman and Secretary were appointed in the persons of Mr. S. Briggs and Mr. White. At a further meeting held on Tuesday evening, April 26th, 1892, additional officers were elected, as follows: 1st Vice-Chairman, Mr. A. T. Neill; 2nd Vice-Chairman, Mr. Robert Moodie; Chairman of Executive, Mr. J. W. Grant; the Secretary being appointed Treasurer.

The object of the Photographic Section is for the general research and advancement of photography among its members by holding monthly meetings on the last Tuesday of every month, when all work done during the month will be on the table for examination and criticism.

To become an active member of the Section and enjoy the privileges of the use of the dark-room, it is necessary for the life of the Section that an annual fee of fifty cents be charged; the Section has also placed lockers in the room, for which a yearly rental of fifty cents is charged.

WILLIAM WHITE,
Secretary.

SAMUEL BRIGGS,
Chairman.

HAMILTON ASSOCIATION.

Statement of Receipts and Disbursements for the Year ending May 11th, 1892.

INCOME.

Balance, 1891	$343 06
Proceeds, Sale of Books *re* Birds	15 00
Government Grant	400 00
Rent of Hall	12 00
Members' Subscriptions	110 00
	$880 06

EXPENSES.

Rent and Gas	$158 00
Printing, Stationery and Postages	321 46
Lecture Expenses, Com., Caretaker and Sundries	94 95
Allowance to ex-Secretary, per resolution	50 00
Balance	255 65
	$880 06

RICHARD BULL,
Treasurer.

Have examined vouchers and found them correct.

GEO. BLACK,
Auditor.

May 12th, 1892.

THE JOURNAL AND PROCEEDINGS OF THE HAMILTON ASSOCIATION

IS SENT TO THE FOLLOWING:

I.—AMERICA.

(1) CANADA.

Canadian Institute	Toronto.
Natural History Society of Toronto	"
Department of Agriculture	"
Library of the University	"
Geological Survey of Canada	Ottawa.
Ottawa Field Naturalists' Club	"
Ottawa Literary and Scientific Society	"
Royal Society of Canada	"
Department of Agriculture	"
Department Arts, Agriculture and Statistics	"
Entomological Society	London.
Kentville Naturalists' Club	Kentville, N. S.
Murchison Scientific Society	Belleville.
Natural History Society	Montreal.
Library of McGill University	"
Nova Scotia Institute of Natural Science	Halifax.
Literary and Historical Society of Quebec	Quebec.
L'Institut Canadian de Quebec	"
Natural History Society of New Brunswick	St. Johns.
Manitoba Historical and Scientific Society	Winnipeg.
Guelph Scientific Association	Guelph.

(2) UNITED STATES.

Kansas Academy of Science	Topeka, Kan.
Psyche	Cambridge, Mass.

American Association for Advancement of Science	Salem, Mass.
National Academy of Sciences	Cambridge, Mass.
Museum of Comparative Zoology	" "
American Dialect Society	" "
United States Department of Agriculture	Washington, D.C.
Biological Society of Washington	" "
Philosophical Society of Washington	" "
Smithsonian Institution	" "
United States Geological Survey	" "
American Society of Microscopists	Buffalo, N. Y.
Buffalo Society of Natural Sciences	" "
California Academy of Sciences	San Francisco, Cal.
California State Geological Society	" "
Santa Barbara Society of Natural History	" "
University of California	Berkely, Cal.
Academy of Natural Sciences	Philadelphia, Pa.
Minnesota Academy of Natural Sciences	Minneapolis, Minn.
Academy of Sciences	St. Louis, Mo.
Missouri Botanical Gardens	" "
American Chemical Society	New York City.
American Astronomical Society	" "
American Geographical Society	" "
New York Academy of Sciences	" "
Torrey Botanical Club	" "
Central Park Menagerie	" "
Cornell Natural History Society	Ithaca, N. Y.
Johns Hopkins University	Baltimore, Md.
Kansas City Scientist	Kansas City, Mo.
Wisconsin Academy of Science, Art and Letters,	Madison, Wis.
Society of Alaskan Natural History and Ethnology	Sitka, Alaska.
Agricultural College	Lansing, Mich.
Colorado Scientific Society	Denver, Col.
Museum of Natural History	Albany, N. Y.

(3) WEST INDIES.

Institute of Jamaica	Kingston, Jamaica.

II.—EUROPE.

(1) GREAT BRITAIN AND IRELAND.

England.

Bristol Naturalists' Club ....Bristol.
Literary and Philosophical Society of Leeds....Leeds.
Conchological Society .... "
Royal Society.............................London.
Royal Colonial Institute .... "
Society of Science, Literature and Art......... "
Geological Society .... "
Manchester Geological Society...............Manchester.

Scotland.

Glasgow Geographical Society................Glasgow.
Philosophical Society...................... "

Ireland.

Royal Irish Academy.......................Dublin.
Royal Geological Society of Ireland........... "
Naturalists' Field Club......................Belfast.

(2) AUSTRIA-HUNGARY.

Anthropologische Gesellschaft ....Vienna.
K. K. Geologische Reichsanstalt............ "

(3) BELGIUM.

Société Géologique de Belgique..............Liège.

(4) DENMARK.

Société Royal des Antiquaires du Nord........Copenhagen.

(5) FRANCE.

Académie Nationale des Sciences, Belles-Lettres et Arts..............................Bordeaux.
Académie Nationale des Sciences, Arts et Belles-Lettres...............................Caen.
Académie Nationale des Sciences, Arts et Belles-Lettres...............................Dijon.
Société Géologique du Nord.................Lille.
Société Géologique de France................Paris.

(6) GERMANY.

Naturwissenschaftlicher Verein .... Bremen.
Naturwissenschaftlicher Verein .... Carlsruhe.

(7) RUSSIA.

Comité Géologique .... St. Petersburg.

III.—ASIA.

(1) INDIA.

Asiatic Society of Bengal .... Calcutta.
Geological Survey of India .... "

(2) STRAITS SETTLEMENT.

The Straits Branch of the Royal Asiatic Society. Singapore.

(3) JAPAN.

Asiatic Society of Japan .... Tokyo.

IV.—AFRICA.

(1) CAPE COLONY.

South African Philosophical Society .... Cape Town.

V.—AUSTRALASIA.

(1) AUSTRALIA.

The Australian Museum .... Sydney.
Royal Society of New South Wales .... "
Linnean Society of New South Wales .... "
Australian Natural History Museum .... Melbourne.
Public Library of Victoria .... "
Royal Society of Queensland .... Brisbane.

(2) NEW ZEALAND.

New Zealand Institute .... Wellington.

(3) TASMANIA.

Royal Society of Tasmania .... Hobarton.

LIST OF MEMBERS

OF THE

HAMILTON ASSOCIATION.

HONORARY.

1881 Grant, Lt.-Col. C. C., Hamilton.
1882 Macoun, John, M. A., Ottawa.
1885 Dawson, Sir J. Wm., F. R. S., F. G. S., F. R. S. C., Montreal.
1885 Fleming, Sanford, C. E., C. M. G., Ottawa.
1885 Wilson, Sir Daniel, LL. D., F. R. S. E., Toronto.
1885 Farmer, William, C. E., New York.
1885 Ormiston, Rev. William, D. D., Pasadena, Cal.
1885 Rae, John, M. D., F. R. G. S., LL. D., London, Eng.
1886 Small; H. B., Ottawa.
1886 Charlton, Mrs. B. E., Hamilton.
1887 Dee, Robert, M. D., New York.
1887 Keefer, Thos. C., C. E., Ottawa.
1890 Burgess, T. J. W., M. D., F. R. S. C., Montreal.
1891 Moffat, J. Alston, London.

CORRESPONDING.

1870 Wright, Prof. W. P., M. A., Los Angeles, California.
1871 Seath, John, M. A., Toronto.
1881 Clark, Chas. K., M. D., Kingston.
1881 VanWagner, P. S., Stony Creek.
1881 Spencer, J. W., B. Sc., Ph. D., F. G. S., Savannah, Ga.
1882 Lawson, A. C., M. A., California.
1884 Bull, Rev. Geo. A., M. A., Niagara Falls South.
1885 Frood, T., Sudbury.
1889 Yates, Wm., Hatchley.
2889 Wilkins, D. F. H., B. A., Bac. App. Sci., Beamsville.
1889 Kennedy, Wm., Austin, Tex.
1891 Hanham, A. W., Quebec.
1892 Woolverton, L., M. A., Grimsby.

LIFE.

1885 Proudfoot, Hon. Wm., Q. C., Toronto.

ORDINARY.

1892 Adam, Alex. E.
1882 Adam, Jas. R.
1881 Aldous, J. E. P., B. A.
1872 Alexander, A., F. S. Sc.
1892 Alexander, Ernest
1891 Arthur, C. C., M. A.
1892 Baker, C. O.
1885 Baker, Hugh C.
1880 Ballard, W. H., M. A.
1880 Barr, J. A.
1881 Barton, G. M.
1891 Birkenthal, Rev. H., Ph. D
1880 Black, Geo.
1890 Bonny, H. P.
1881 Boustead, Wm.
1892 Bowman, J. W.
1881 Bowman, Wm.
1880 Briggs, Samuel
1857 Brown, Adam
1891 Brown, O. J., M. A.
1885 Buchanan, W. W.
1892 Buckley, Miss M. A.
1857 Bull, Richard
1892 Burkholder, J. G. Y.
1880 Burns, Rev. A., D. D., LL.D.
1891 Burns, J. M.
1889 Campbell, D. J.
1892 Cameron, Chas. C.
1890 Cape, John
1891 Carpenter, H., B. A.
1891 Chapman, J. R.
1891 Chapman, W.
1880 Charlton, B. E.
1891 Cheyne, John P., Commander R. N.
1884 Childs, W. A., M. A.
1890 Clark, D., D. D. S.
1890 Cloke, J. G.
1887 Colquhoun, E. A.
1891 Crawford, J. T., B. A.
1892 Crisp, Alf. C.
1880 Cummings, James
1892 Cuttriss, Geo. H.
1872 Dickson, George, M. A.
1880 Dillabough, F. H., M. D.
1892 Devine, A. L
1891 Eastwood, John M.
1890 Elliott, W. H., Ph. B.
1881 Evans, J. De V.
1891 Evans, W. Sanford
1881 Fearman, F. W.
1882 Ferres, James
1890 Finch, C. S.
1880 Findlay, W. F.
1880 Fletcher, Rev. D. H., D. D
1880 Forbes, A. F.
1891 Foster, F. G.
1880 Foster, W. C.
1892 Garrett, A. D.
1880 Gaviller, Alex.
1882 Gaviller, E A., M. D.
1883 Gibson, Hon. J. M., M.A., LL. B.
1888 Grant, A. R.
1892 Grant, W. J.
1887 Green, Joseph
1883 Grossman, Julius
1888 Galbraith, W. S.
1887 Hancock, Wm.
1882 Harris, W. J.
1891 Heming, A. H.
1889 Herald, Joseph
1887 Hobson, Thos.
1890 Holden, Mrs. J. Rose
1892 Holliday, John, M. A.

1887 Ireland, S. J.
1892 King, A., M. A.
1882 Laidlaw, Rev. R. J., D. D.
1890 Lancefield, R. T.
1884 Lee, Lyman, B. A.
1892 Lees, Geo.
1890 Lees, Thomas
1857 Leggat, Matthew
1890 Leslie, Geo. M.
1880 Leslie, James, M. D.
1880 Littlehales, Thomas
1891 Locheed, L. T., B. A.
1887 Logie, W. A., B. A.
1880 Lyle, Samuel, Rev., B. D.
1891 McClemont, Wm. M.
1891 McCullough, C. R.
1857 McIlwraith, Thos.
1890 McInnes, Hon. Donald
1884 McLaren, Henry
1890 McLaughlin, J. F., B. A.
1880 Macdonald, J. D., M. D.
1857 Malloch, A. E., M. D.
1891 Manning, A. E.
1890 Marshall, Wm.
1886 Martin, Edward, Q. C.
1892 Mathesius, R. A.
1892 Mills, Edwin
1887 Mills, Geo. H.
1886 Milne, Alex.
1891 Mole, Wm., M. R. C. V. S.
1892 Moodie, Jas. R.
1887 Moore, A. H.
1890 Moore, Charles
1890 Moore, Henry E.
1892 Morgan, Arthur
1891 Morgan, S. A., B. A.
1886 Morgan, W. S.
1887 Morris, Thomas, Jr.
1883 Murton, J. W.
1870 Mullin, John A., M. D.
1891 Myles, Wm. H.
1880 Neill, A. T.
1887 Nelligan, J. B.
1892 Overell, M. J.
1885 Plant, John
1891 Rastrick, E. L.
1891 Rastrick, F. J.
1881 Reynolds, T. W., M. D.
1890 Roach, George
1892 Robertson, R. A.
1882 Robinson, W. A.
1892 Ross, Lucien G.
1887 Sanford, Hon. W. E.
1890 Schofield, W. H., B. A.
1880 Scriven, P. L.
1891 Sinclair, S. B., M. A.
1885 Smart, Wm. L.
1892 Southam, Richard
1890 Staunton, F. H. Lynch
1890 Staunton, Geo. Lynch
1892 Stark, Robert
1890 Stratton, A. W., B. A.
1892 Sweet, David
1892 Sweet, Harry
1892 Smith, J. H.
1892 Thompson, R. A., B. A.
1881 Tuckett, Geo. E.
1891 Turnbull, A. C.
1892 Turnbull, J. D.
1892 Turnbull, W. R.
1880 Turnbull, William
1891 Turner, J. B., B. A.
1892 Turner, W. J.
1891 Tyrrell, J. W.
1881 Vernon, Elias, M. D.
1887 Walker, A. E.
1892 White, Wm.
1888 Williams, C. J.

1881 Williams, J. M.
1892 Wilson, Wm.
1857 Witton, H. B.
1885 Witton, H. B., Jr., B. A.
1891 Witton, J. G., B. A.
1884 Young, Wm.

HAMILTON ASSOCIATION.

OFFICERS, 1892-93.

President.

A. ALEXANDER, F. S. Sc., Lon., Eng.

1st Vice-President.

A. T. NEILL.

2nd Vice-President.

S. BRIGGS.

Corresponding Secretary.

THOMAS MORRIS, Jr.

Recording Secretary.

C. R. McCULLOUGH.

Treasurer.

RICHARD BULL.

Curator.

ALEX. GAVILLER.

Assistant Secretary and Curator.

GEO. M. LESLIE.

Council.

T. W. REYNOLDS, M. D. W. A. ROBINSON. P. L. SCRIVEN.
WM. TURNBULL. WM. WHITE.